CITY OF NORTHAMPTON

Broadband Feasibility Analysis

DESIGN NINE
broadband planners

TABLE OF CONTENTS

1 EXECUTIVE SUMMARY

Affordable high speed Internet is essential to the future growth and prosperity of Northampton. Over the past twenty years, Internet access has evolved to become important to both households and businesses, and the COVID-19 crisis has made it clear that affordable high performance Internet access is not a luxury but a necessity.

School students need Internet access to complete homework and to study, and while at the time of the writing of this report, most students in the U.S. have returned to school at least part time, online and "virtual classroom" learning is not going away. Many colleges have made the decision to permanently increase the type and number of fully online classes. Students living off campus in Northampton need excellent Internet service, preferably with options to purchase symmetric Internet (equal upload and download speeds); symmetric Internet makes two way video perform much better.

Online shopping can save energy and make it easier for the elderly and homebound to obtain the needs of every day life. Once again, the COVID-19 crisis during the lockdown periods, made online shopping not just a convenience but a necessity for many Northampton residents. Telemedicine and telehealth services and applications are revolutionizing health care, reducing costs, and allowing older citizens to live independently longer. More and more workers and business people are working from home, either on a part time or a full time basis. New work from home job opportunities are growing rapidly, but most of those jobs require reliable, symmetric Internet service to qualify.

Perhaps the most striking effect of the COVID-19 lockdowns was the extraordinary number of office workers who suddenly had to try to work from home, often for many months. As the time of this writing, many corporations have indicated that most of their workers will continue to work from home at least well into 2022.

While many business employees were already trying to work more from home more often (e.g. one or two days per week) to reduce commuting costs, the ability to work from home productively has become a critical economic development issue. Corporate employees working from home require high bandwidth services to be connected to the office network and to use corporate videoconferencing systems. These corporate network services often require a minimum of 25-50 Megabit symmetric connections.

1.1 BROADBAND SURVEY RESULTS

During the Spring of 2021, a broadband survey of both businesses and residential citizens was conducted in the city of Northampton Massachusetts as part of a city wide study in broadband needs. The online (Web) version of the survey was publicized on social media. Residents were encouraged to complete the survey online or fill out and return the paper version by surface mail. Businesses were encouraged to complete a separate business-focused survey, and the results of that are included later in this report.

A total of 2,993 responses were collected in the residential survey. Not all responders answered every question. Note that because of rounding, not all percentages sum exactly to 100%. Many comments were received.

Some of the key findings from the results are listed below.

From the residential survey:

- 87% of respondents were interested in faster and more reliable service.
- 36% of respondents were "dissatisfied" or "very dissatisfied" with their current Internet service.
- 82% of residential respondents said they would be "somewhat" or "very" likely to switch to a faster, city-developed network.
- 72% of residents have 5 or more Internet-connected devices in their home.
- 40% of respondents report they have trouble using common Internet services.
- 67% indicate that availability of broadband Internet is affecting where they choose to live.

Perhaps the statistic that should receive the most attention is that 67% of respondents suggested that the availability of broadband Internet was influencing their decision about where to live. This is the highest number we have seen in more than eight years of conducting these surveys—more typically, that number averages about 35%.

From the business survey:

- 86% of business respondents want better Internet access.
- 94% indicated that the Internet is important to the success of their business over the next five years.
- 16% of the businesses that responded are home-based.
- 92% of business respondents said they would be "somewhat" or "very" likely to switch to a faster, city-developed network.
- Only 33% of businesses are "satisfied" or "very satisfied" with their current Internet service.
- 37% of businesses that responded need employees to be able to work from home.

1.2 BROADBAND AS ESSENTIAL INFRASTRUCTURE

Just as communities had to take on the task of building and maintaining roads in the early twentieth century, communities must now provide digital road systems as a matter of community and business survival. These digital road systems must be designed with certain characteristics:

Future Oriented Infrastructure

Current usage patterns are not a good predictor of future broadband needs. Network investments in Northampton must be designed to scale gracefully to support future uses over the next thirty years. Those uses include K12 education, work from home opportunities, telemedicine and telehealth services, home security, energy management, and many other emerging services and uses. The City should invest in infrastructure that will meet future needs, not current demand. A "future proof" Northampton includes:

- Abundant, inexpensive bandwidth locally
- Massive connection to the rest of the world
- Network redundancy available in some areas of the City
- Rich local content from a multitude of sources

The Northampton of the future will be attractive to an emerging new group of business people and entrepreneurs that typically are well-educated, own their own businesses or work for large global corporations, and are making choices about where they lived based on family needs and interests, rather than business interests. This new breed of entrepreneurs and workers place a high value on the kinds of amenities that contribute to a good quality of life–traditional neighborhoods, vibrant downtown areas, a wide range of cultural and recreation opportunities, good schools, and a sense of place. These businesspeople and their families make relocation decisions based on quality of life only where there is abundant and affordable broadband, because broadband is the enabler of this new approach to personal and work life.

We recommend that any City fiber effort have the following characteristics:

City-wide access – The goal of a City fiber initiative should be to deliver high performance fiber services to all residents and businesses as rapidly as possible consistent with fiscally conservative funding and operations.

Scalable - The network design should support a graceful expansion over time to support future community and economic development goals.

Business-class Capable - The network should be able to deliver any amount of bandwidth needed by any business connected to the network, with any desired quality of service (QoS) required to make Northampton businesses competitive in the world economy.

Symmetric Bandwidth - The COVID crisis highlighted the weaknesses of most broadband infrastructure in the United States. Work from home and distance learning showed the importance of the availability of symmetric bandwidth (equal download and upload speeds) in homes and businesses. Fiber networks have the capacity to provide symmetric bandwidth as a standard and universal service.

Redundancy and Resiliency – The network should be designed with a redundant "ring" architecture to minimize downtime from accidental fiber cuts and network equipment failures. Northampton businesses and anchor tenants will have a high reliability network.

Standards-based Network Architecture - The network should be operated as a single high performance lit fiber (Layer 2) network. A lit network design should be based on a Gigabit fiber architecture using a GPON design for high performance residential service, and the network should be designed to deliver Active Ethernet to businesses and institutions that require the highest levels of performance. This approach will provide a "future proof" fiber infrastructure capable of delivering any current or future service.

1.3 NEXT STEPS

Set Project and Funding Goals

City leaders should review the recommendations in this report and set one-, two-, and three-year project and funding goals. These goals should be used to provide guidance on which grants to apply for and which projects and areas should be be included in each grant application. The project and funding goals document should be reviewed and updated twice yearly.

The City Should Not Be an Internet Service Provider

The City can play an important role by providing "basic" broadband infrastructure (e.g. conduit, dark fiber, handholes, and even lit fiber circuits) to private sector Internet Service Providers (ISPs), who would be responsible for selling their own Internet services and providing customers support. Leasing City-owned broadband infrastructure can, over time, generate a revenue that can be used to expand the network and eventually contribute to the City general fund.

Identify the City Champion

To be successful, the project will need a City staff member who "owns" the project and will provide the leadership and act as the single point of contact for the effort. Even if most or all activities are outsourced to the private sector (e.g. construction, procurement, operations, billing, etc.) someone from the City must provide the necessary leadership and day to day supervision.

Apply for Immediate Grant Opportunities

The availability of COVID-19 and ARPA relief funds represents a potentially one time strategic opportunity to make City investments in broadband infrastructure that could have long lasting economic and community development benefits for the City and its residents and businesses.

Develop a funding strategy

Grants may not provide sufficient funds to reach the City's long-term goals. The City has several options that could assist with funding, including Federal and state grant funds, a special assessment, or a broadband utility fee, among other funding strategies. The Federal broadband grant programs present a one time opportunity to fund a large portion of a citywide fiber network.

Wholesale Business Model or Public/Private Partnership

One option for the city is to build and own the network and operate it on an open access, wholesale business model with a wide range of competitive providers offering business and residential services.

A second option is to develop a public/private partnership (PPP) with a private sector Internet Service Provider (ISP). A PPP can take several forms, but some of the ways the partnership could be developed could include the City providing some financing in return for service guarantees for service to all neighborhoods and business areas of the City. Another option would be for the City to own the infrastructure but bid out all of the operations, maintenance, billing and customer management to an ISP that offers the best financial deal to the City.

Focus on Wider Availability of Fiber Access

Some residents and businesses in the City still rely on poor DSL internet access and need an alternative. The existing incumbent cable Internet service in the City is unable to provide symmetric service to residents and businesses (i.e. equal upload and download speeds). Symmetric Internet service is critically important to support work from home, business from home, and remote learning for both K12 and college students.

Fund for Success

Expansion of affordable, high performance broadband in the City will be most successful by recognizing that funding will come from a range of funding sources rather than a single source.

Grants, public/private partnerships, some local funds, and other sources may all be needed to achieve success.

Grants can be extremely important in the early stages of an effort to support planning activities and/or to fund a first-phase build-out initiative. However, grants rarely allow spending on operational expenses. Grants should be used carefully as one-time cash injections to support very specific goals. Communities that have relied too heavily on "the next grant" as a key source of expansion or operational funding usually experience severe financial problems.

Expand the Existing City-Owned Fiber Network

The City already has some fiber infrastructure that could be leveraged in a variety of ways to support either a City-owned fiber network provided on a wholesale basis to private sector ISPs and/or a public/private partnership arrangement.

Evaluate Wider Distribution of Smart Poles

The City has begun to deploy some "smart poles" in the areas around some municipal buildings. Smart poles can be configured to deliver a variety of services, including WiFi Internet service and providing cellular 4G/5G service in areas of the city where there may be cellular dead spots and/or poor cellular signals.

Public Safety Synergy

A City fiber network can become the basis of a city-wide "smart pole" initiative that can provide enhanced public safety services, reduce visual clutter, generate revenue, and reduce City electric costs. Smart poles can have space for visually unobtrusive 5G cell sites (a revenue stream), WiFi hotspots for downtown visitors and shoppers, and motion sensors to dim or turn street lights on only when cars or pedestrians are nearby.

1.4 THE SMART CITY CONCEPT

The fiber infrastructure under consideration could be the basis for making Northampton a "smart city." Smart cities use broadband infrastructure as the base for IoT (Internet of Things) technology, including sensors of various kinds used to collect and analyze data. IoT "smart city" sensors can support a wide range city services and needs, including

- Sensors that indicate when a public trash receptacle needs to be emptied.
- Reporting potholes that need repair.
- Managing traffic lights more efficiently to improve traffic flow. Smart mobility applications can reduce commuting time and help drivers use less fuel while traveling in the city.
- Managing street lights by including motion sensors that dim the lights when there are no vehicles or pedestrians near the light—and saving energy.
- Improved public safety with security cameras that would provide real time monitoring of areas of the city with crime problems.
- Improved mass transit (e.g. bus routes) by monitoring usage and changing bus schedules based on the time of day and demand data.

- Providing citizens with real time health data throughout the city (e.g. ozone levels, temperature, air pollution index, etc.). This data can be shared with citizens and businesses by smartphone apps to enable at-risk individuals to receive real time information about air quality.
- Ubiquitous high performance broadband connections in homes and apartments can support real time monitoring of chronic health problems, making diagnosis and treatment of those health issues more effective and less time-consuming.
- High performance broadband connections in residences can support wider use of telemedicine, reducing travel time to and from health facilities, and for chronic health problems, provide more frequent medical attention at less time and cost.
- Monitoring of electricity and water use can provide useful information to help reduce energy and water use

2 CITY INFRASTRUCTURE OPTIONS

2.1 OVERVIEW OF BROADBAND INFRASTRUCTURE OPTIONS

City-installed conduit/pole space

In this model, the City would underwrite the cost of citywide underground conduit and some limited aerial fiber. The existing city utility poles will likely require extensive make-ready, and the amount of affordable aerial fiber routes is likely to be limited.

This approach means the City takes on a large percentage of the cost of deploying conduit to pass most homes and businesses (as much as 65% of the total cost of complete network), but would receive only limited revenue from leasing out conduit. The City would have to find an ISP willing to pay for the additional cost of adding fiber and all the network equipment. If a single provider was given full access to the entire conduit network, a new ISP monopoly would be essentially in place in the City.

Recommendation: High cost, limited revenue, and potential new monopoly provider makes this the least desirable option.

City-installed conduit/pole space and dark fiber

In this model, the City underwrites the cost of conduit and dark fiber (no network electronics). Fiber strands would be leased out to one or more ISPs, and each ISP would install and support their own network electronics. The City would be responsible for repairs and maintenance on the fiber, which would be limited. The revenue the City would receive from leasing fiber strands could cover most routine and emergency fiber repairs and maintenance. In this approach, if a single provider is awarded exclusive access to the fiber in return to offering service to all premises, a new monopoly has been created. If multiple providers are allowed to bid on leasing fiber, some areas of the City might have more than one provider (competition), but other areas of the City (e.g. low and moderate income neighborhoods) might not have any fiber service.

Recommendation: High cost, better revenue potential, and the dark fiber leasing would have to designed and managed carefully to ensure that all business and residential locations get service.

City-installed conduit/pole space, fiber and City as ISP

In this model, the City underwrites the cost of conduit, fiber, and network electronics, creating a fully operational "lit" network. The City would buy Internet service wholesale and become a retail provider of Internet. This would require significant end user (retail) customer support, and would likely trigger a lawsuit from one or more incumbent providers.

Recommendation: High cost, good revenue, but the approach requires a high level of management, including both 24/7/365 network management and retail customer management. The risk of a lawsuit is high.

City-installed conduit/pole space, and lit fiber

In this model, the City underwrites the cost of conduit, fiber, and network electronics, creating a fully operational "lit" network. The City would operate the network on an open access basis,

offering lit circuits to any ISP. For the market size, it is likely that Northampton could attract at least two providers to the City, who would use the City network to deliver their own packages of Internet services. Every premises in the City would have access to the City network, but the participating ISPs would be responsible for selling Internet to their customers and handling customer support. For network management, the City could outsource the network management or handle it internally as part of the IT department (other municipalities have take both approaches).

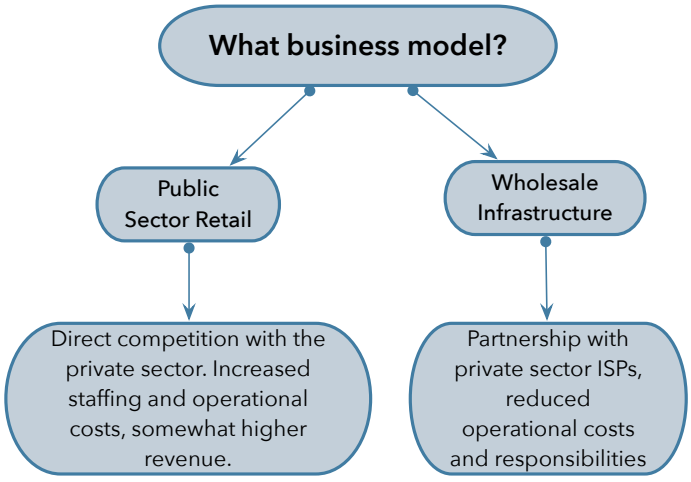
Recommendation: The lit fiber option would create a competitive marketplace for Internet services. This approach has been adopted by other municipalities around the U.S., and is the recommended approach for Northampton. A modern Gigabit fiber network owned by the City and managed on an open access basis has the most revenue potential and best opportunity for long term financial success. It is important to note that the City would NOT be an Internet Service Provider (ISP) in this model. Homes and businesses in Northampton would continue to purchase their Internet service from private sector providers.

2.2 BUSINESS MODEL OPTIONS

Traditionally, the telecom services market has been vertically integrated, with telephone and cable companies owning the cable infrastructure (i.e. twisted pair copper cable for telephone, and coaxial copper cable for TV). These companies bundled analog services with their own infrastructure, which made sense when only one service could be delivered over the cable.

American residents and businesses needed two networks: one for voice telephone service, and one for television. The rise of the Internet and associated changes in technology led to digital services (voice, video, Internet) that could be delivered simultaneously over a single cable or wireless connection.

By the early 2000s, it was becoming apparent that it was inefficient and costly to have two competing "retail" cable systems (e.g. telephone, cable) delivering the same content and services—it was only creating higher costs for residents and businesses.



A new business model became possible: wholesale leasing of the cable/wireless infrastructure to private sector service providers, which unbundles the infrastructure from the services. A side effect of this unbundling is that it becomes much easier to determine what a customer is actually paying for a given service: in the vertically integrated 20th century model, with the cost of infrastructure maintenance bundled together with the services, it is much more difficult to determine what a service actually costs.

While a few communities have pursued the retail business model (typically building fiber to the home and business and selling retail Internet and other services directly to customers), most of

these retail efforts have been by local governments that are also providing electric service—owning the utility poles is a significant cost advantage not available in most communities.

Within the wholesale business model, there are several different ways to generate revenue.

Public/Private Partnership —The City could solicit proposals from private sector ISPs to develop a public/private partnership (PPP). A PPP can take several forms, but some of the ways the partnership could be developed could include the City providing some financing in return for service guarantees for service to all neighborhoods and business areas of the City. Another option would be for the City to own the infrastructure but bid out all of the operations, maintenance, billing and customer management to an ISP that offers the best financial deal to the City. A simple Request For Proposal (RFP) could be issued to solicit proposals from the private sector.

Passive Infrastructure Leasing – In this approach, the City makes investments in a few targeted passive infrastructure types, typically conduit and dark fiber. This kind of basic infrastructure has virtually no day to day maintenance and management responsibilities, and can be leased out to private sector Internet providers so that those companies can expand their service area and service quality more rapidly.

Lit Circuit and Dark Fiber Wholesale – In this approach, the network provides lit fiber circuits to providers, with one circuit allocated to each customer. For list circuits, service providers are charged for the cost of each circuit. Service providers are responsible for their own customers and their own customer billing. Revenue is based on the number of customers who actually buy service (the take rate). Revenue is dependent on the marketing success of the service providers.

The City could also offer dark fiber strands to providers, but the dark fiber pricing has to be set carefully to ensure that the dark fiber prices do not cannibalize the demand for lit circuits and undercut the revenue model. Most other municipal networks do offer dark fiber, with carefully designed pricing to avoid undercutting the lit circuit offerings.

Utility Fee Funding – In this approach, every household and business in the community pays a monthly small utility fee. Service providers pay only a small fee for use of the network that is based on the total number of potential customers. In this model, the effective take rate from a revenue perspective is 100%. With this high take rate, the individual utility fee can be very modest because everyone pays something, rather than just those buying a service.

Features	Municipal Retail	Wholesale Infrastructure
Basic Concept	Generally more difficult to because of possible legal challenges from incumbent providers. Generally not an option in Massachusetts.	One or more private sector ISPs would use the infrastructure to sell their own services directly to residents and businesses. Can be a dark fiber approach, lit fiber approach, and/or wireless towers.
Government Involvement	Local government competes directly with the private sector for Internet service.	City involvement is limited to providing basic infrastructure to ISPs.

Management	Local government is responsible for management and operations. Most functions could be outsourced to a qualified third party entity.	ISPs responsible for virtually all day to day customer services and support. City only responsible for network and tower maintenance and repairs.
Competition	The incumbent telephone and cable providers would compete vigorously against local government service offerings.	Private sector ISPs would provide competition to the telephone and cable companies.
Service Options	Local government would sell only Internet. Businesses and residents could get TV and voice using their Internet connections.	ISPs would focus on high speed Internet, with some other service offerings like voice and business services.
Risks	The primary risk would be lawsuits from incumbent providers.	The lit network approach requires hard-nosed business management experience. It is important to identify prospective service providers early in the process.

In the wholesale infrastructure business model, local government investments are limited to basic transport infrastructure, including conduit, fiber, and network equipment. Services for businesses and residents are offered by private sector providers offering Internet, TV, telephone and other data services.

2.3 SERVICE PROVIDERS AND SHARED INFRASTRUCTURE

The wholesale infrastructure model, where the local government is NOT selling retail telecommunications services, has been resistant to legal challenges, with at least one hundred communities in the U.S. that lease infrastructure to private sector service providers. Communities that have been challenged in court are ones that chose to pursue the retail model, with customers purchasing retail services like Internet, TV, and phone directly from the town or city government. Lafayette, Louisiana is one of the best known examples. The City of Lafayette was sued by the incumbent telephone and cable company and won in court. The project is now more than ten years old, passed a 40% take rate target in 2017, and has begun expanding service outside the City limits. The City had a key advantage when starting the effort, because it is an electric city; owning the pole structure and being able to deploy the less expensive aerial fiber widely gave the project a distinct cost advantage.

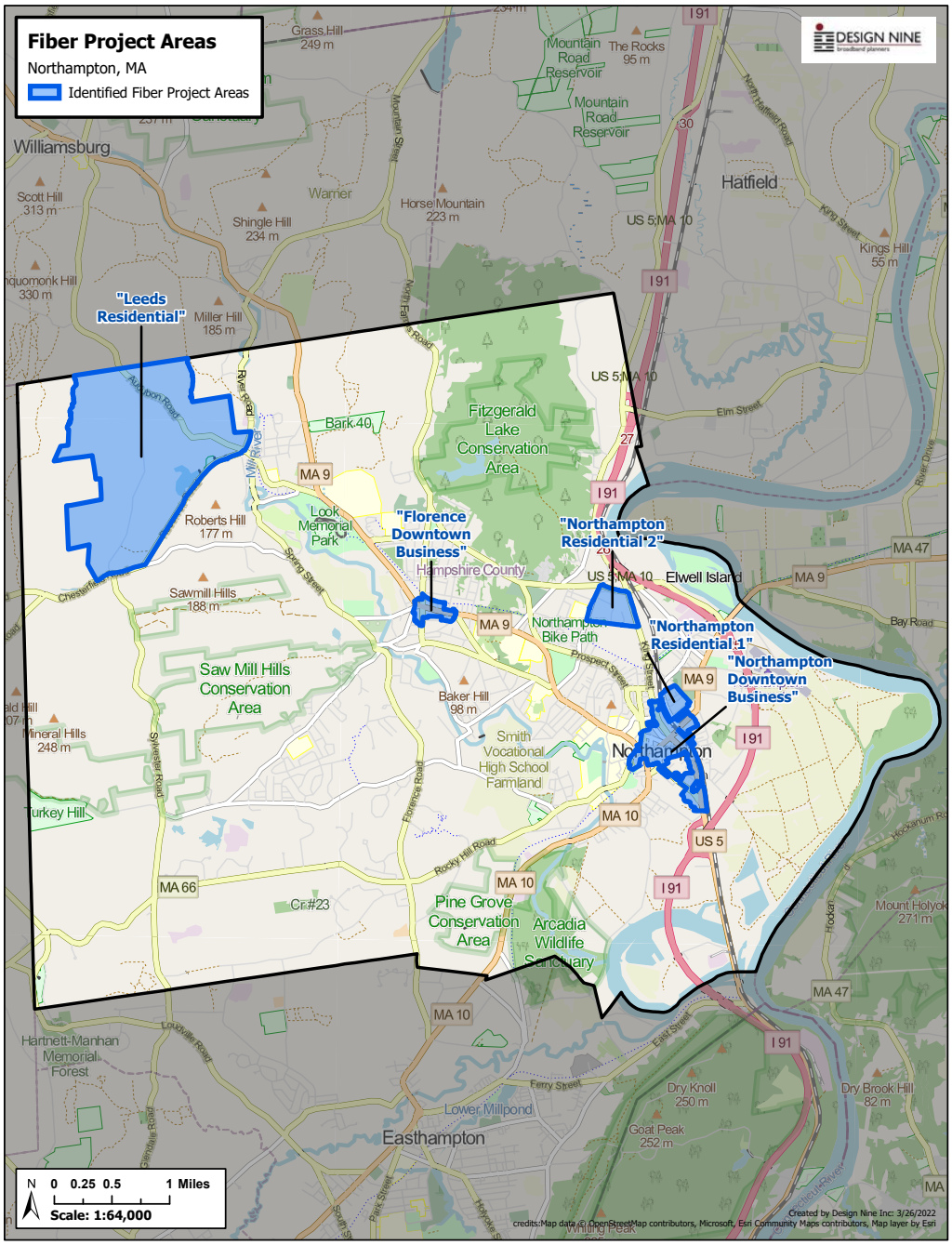
The service providers that are usually most eager to become providers on a community-owned network are smaller local and regional providers. WISPs (Wireless Internet Service Providers) are usually quick to see the advantages of being able to deliver a superior Internet service over a modern fiber infrastructure with little or no capital expense on their part.

Once a community-owned network is under construction, it is typical that the incumbents, particularly the cable companies, begin lowering rates and offering special deals to customers to try to lock them in to multi-year contracts. There are two ways to approach this:

- If the announcement of construction of community-owned infrastructure lowers prices and improves service from the incumbents, that is an economic benefit to the citizens and businesses of the City. The new network, bringing new providers and a wider range of packages and pricing to citizens and businesses, creates the needed competition that motivates the incumbents to provide better prices and service.
- If the City does move forward, a modest but well through out information and education campaign about the benefits and advantages will be important to counter mis-leading information from the incumbents. Part of the effort must be to let citizens and businesses know not to sign long term contracts with the incumbents.

3 CITYWIDE FIBER COST ESTIMATES

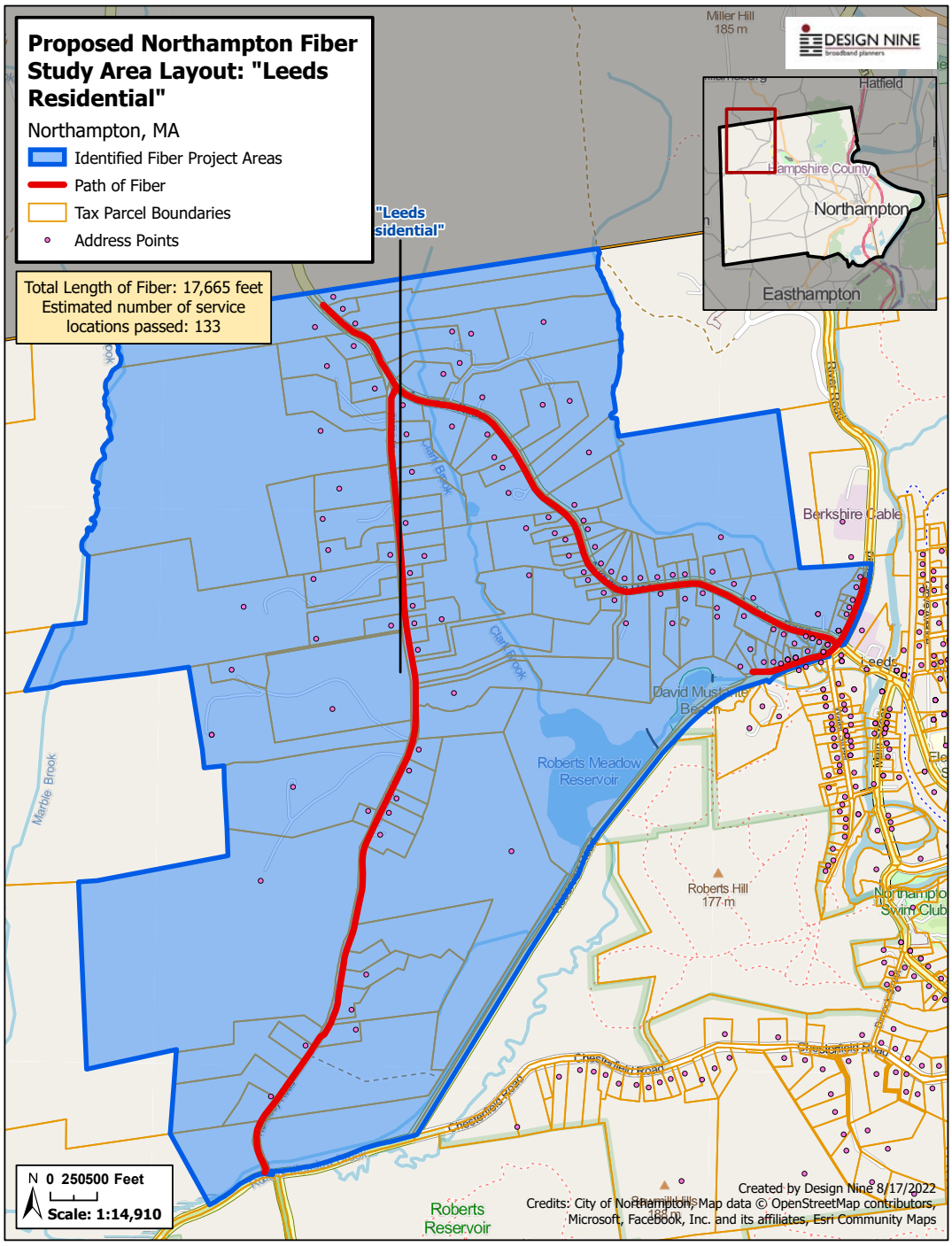
A complete citywide cost estimate for fiber to the home and fiber to the business was developed by analyzing several Northampton neighborhoods and business districts in detail. The cost estimate analysis from these study areas was used to develop a citywide cost estimate.



The study areas are illustrated in the map below.

3.1 STUDY AREA 1: LEEDS RESIDENTIAL

The Leeds area is a typical residential "large lot" area of the city with a mix of lot sizes. Larger lots typically have somewhat higher costs to pass each home and to connect each home.



Northampton Fiber Study Area -Leeds Residential Route Overview

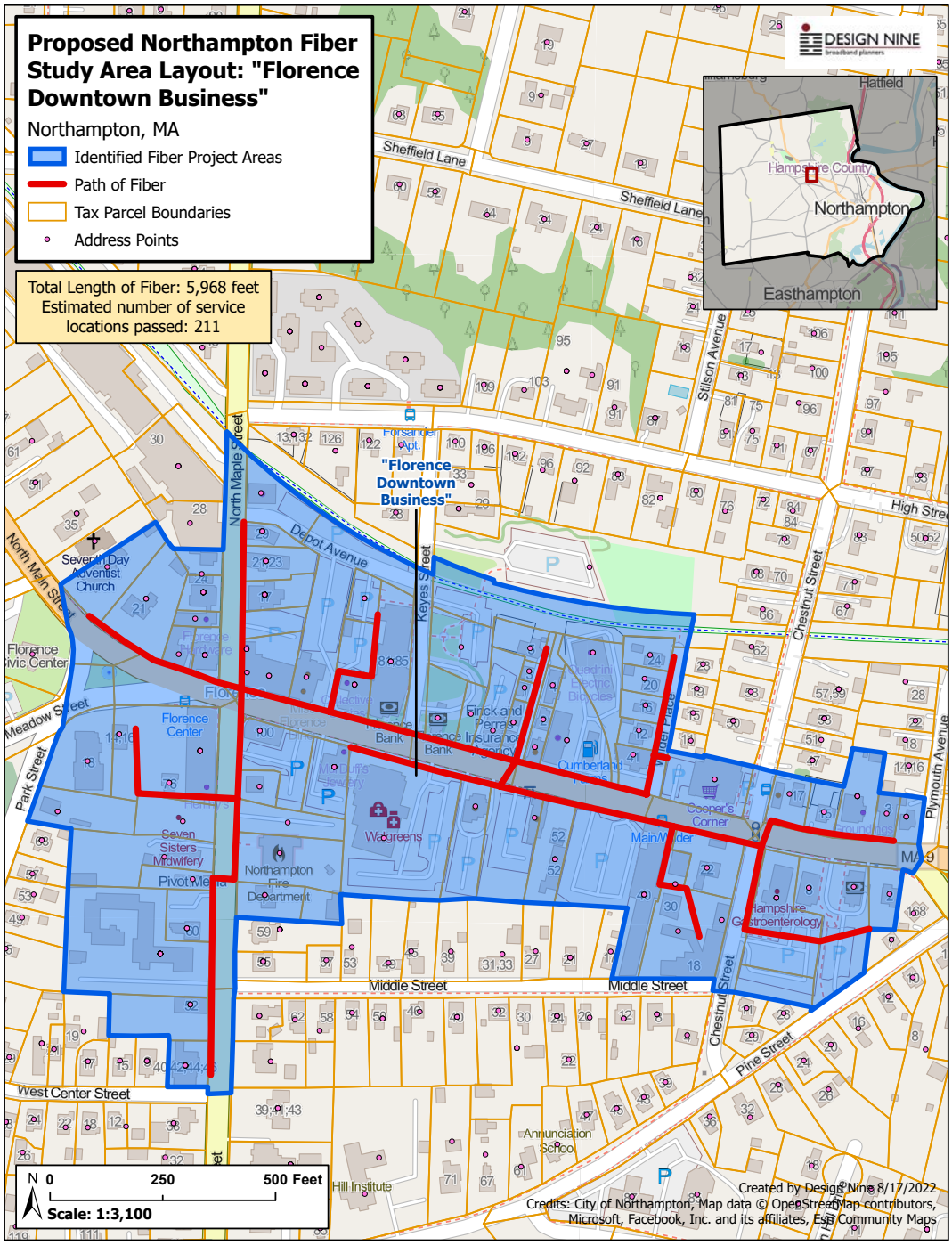
0	ITEM/PROJECT	VALUE
1	Miles of Fiber / Conduit Installed	3.35
2	Number of Handholes Installed	30
3	Splice Closures Installed	16
4	Cabinets Installed	1
5	Number of Buildings Connected	47
6	Take Rate - Percentage of the Buildings Passed who are connected	35%
7	Aerial - Percentage of construction expected to be installed on utility poles.	2%
8	Trenching - Percentage of construction installed by trenching	5%
9	Boring - Percentage of construction installed by horizontal drilling.	43%
10	Slot Cutting - Conduit installed in street by special methods.	0%
11	Rock Saw - Required where rock prevents the use of other methods.	0%
12	Direct Bury - Conduit installed by direct bury methods (plow, vibratory plow)	50%
13	Aerial Info	2% Aerial is estimated to account for water body crossings and other obstacles to construction.
14	Other Notes	Estimated labor rates are based upon common rates seen for recent medium sized rural projects.

Northampton Fiber Pilot -Leeds Residential Cost Summary

0	ITEM/PROJECT	ESTIMATED
1	Northampton Fiber Pilot -Leeds Residential Construction Materials	$156,692
2	Northampton Fiber Pilot -Leeds Residential Distribution Labor	$302,698
3	Northampton Fiber Pilot -Leeds Residential Structures, Cabinets, and Equipment	$68,175
4	Northampton Fiber Pilot -Leeds Residential Drop Construction	$41,313
5	Network Construction Subtotal	**$568,877**
6	Project Mgmt, Network Engineering, Integration, and Testing	$102,398
7	Misc Fees, Advertising, Technical Services	$5,689
8	Bookkeeping and Administration	$4,267
9	Engineering, Permitting	$29,185
10	Legal Costs	$5,689
11	Other Costs Subtotal	$147,227
12	Project Total	**$716,105**
13	Contingency at 5%	$35,805
14	Project Total (with contingency)	**$751,910**

3.2 STUDY AREA 2: FLORENCE DOWNTOWN BUSINESS

This is a typical business district with a mix of commercial and office buildings. Costs in commercial areas can be higher because of more complicated conduit, handhole, and fiber cable placement.



Northampton Fiber Study Area - Florence Downtown Business Route Overview

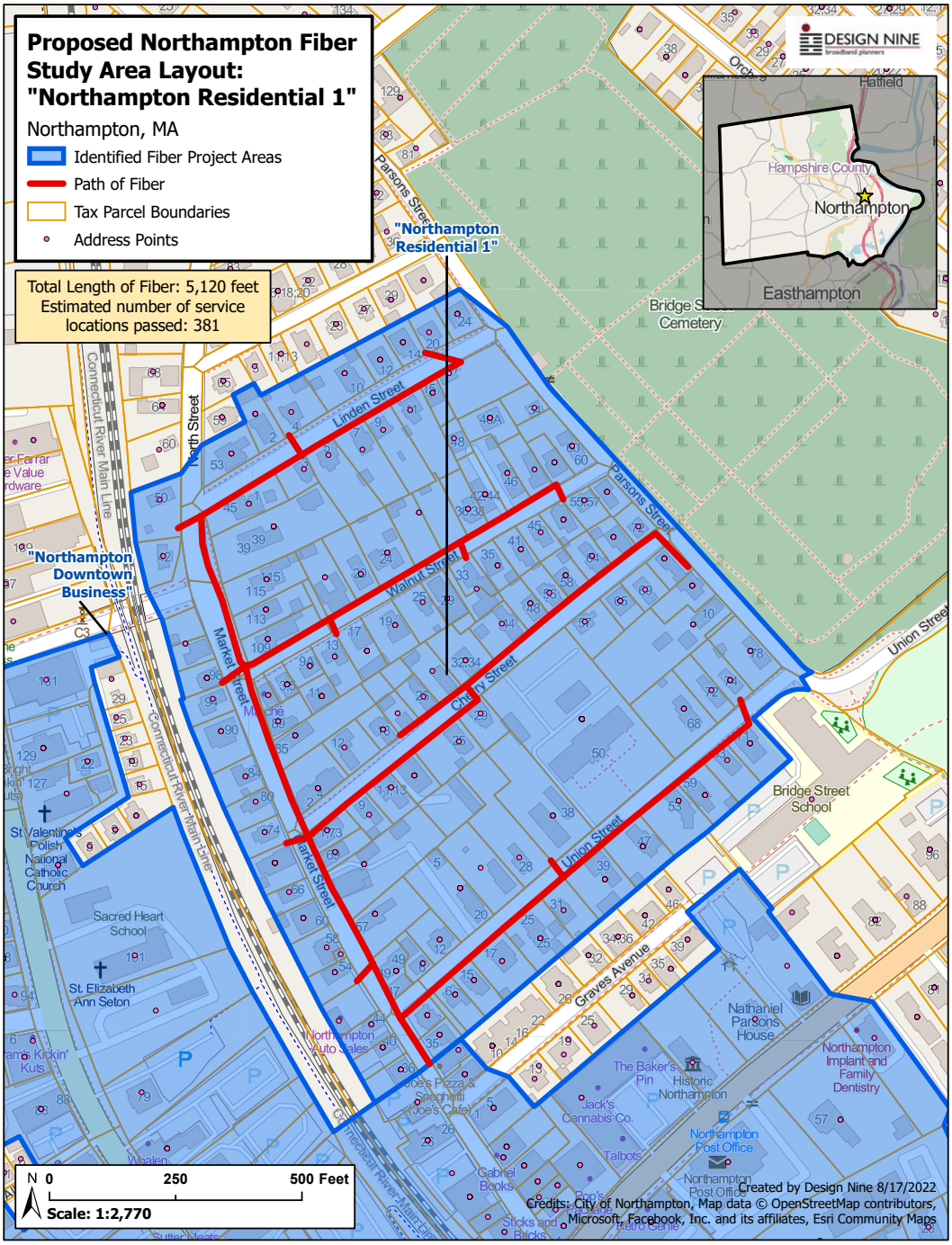
0	ITEM/PROJECT	VALUE
1	Miles of Fiber / Conduit Installed	1.14
2	Number of Handholes Installed	15
3	Splice Closures Installed	37
4	Cabinets Installed	1
5	Number of Buildings Connected	74
6	Take Rate - Percentage of the Buildings Passed who are connected	35%
7	Aerial - Percentage of construction expected to be installed on utility poles.	2%
8	Trenching - Percentage of construction installed by trenching	5%
9	Boring - Percentage of construction installed by horizontal drilling.	63%
10	Slot Cutting - Conduit installed in street by special methods.	0%
11	Rock Saw - Required where rock prevents the use of other methods.	0%
12	Direct Bury - Conduit installed by direct bury methods (plow, vibratory plow)	30%
13	Aerial Info	2% Aerial is estimated to account for water body crossings and other obstacles to construction.
14	Other Notes	Estimated labor rates are based upon common rates seen for recent medium sized rural projects.

Northampton Fiber Pilot - Florence Downtown Business Cost Summary

0	ITEM/PROJECT	ESTIMATED
1	Florence Downtown Business Construction Materials	$71,735
2	Florence Downtown Business Distribution Labor	$155,570
3	Florence Downtown Business Structures, Cabinets, and Equipment	$75,020
4	Florence Downtown Business Drop Construction	$79,675
5	Network Construction Subtotal	**$382,000**
6	Project Mgmt, Network Engineering, Integration, and Testing	$68,760
7	Misc Fees, Advertising, Technical Services	$3,820
8	Bookkeeping and Administration	$2,865
9	Engineering, Permitting	$9,932
10	Legal Costs	$3,820
11	Other Costs Subtotal	$89,197
12	Project Total	**$471,196**
13	Contingency at 5%	$23,560
14	Project Total (with contingency)	**$494,756**

3.3 STUDY AREA 3: NORTHAMPTON RESIDENTIAL ONE

This residential area is typical of several portions of the city, with higher density homes on smaller lots.



Northampton Fiber Study Area - Northampton Residential 1 Route Overview

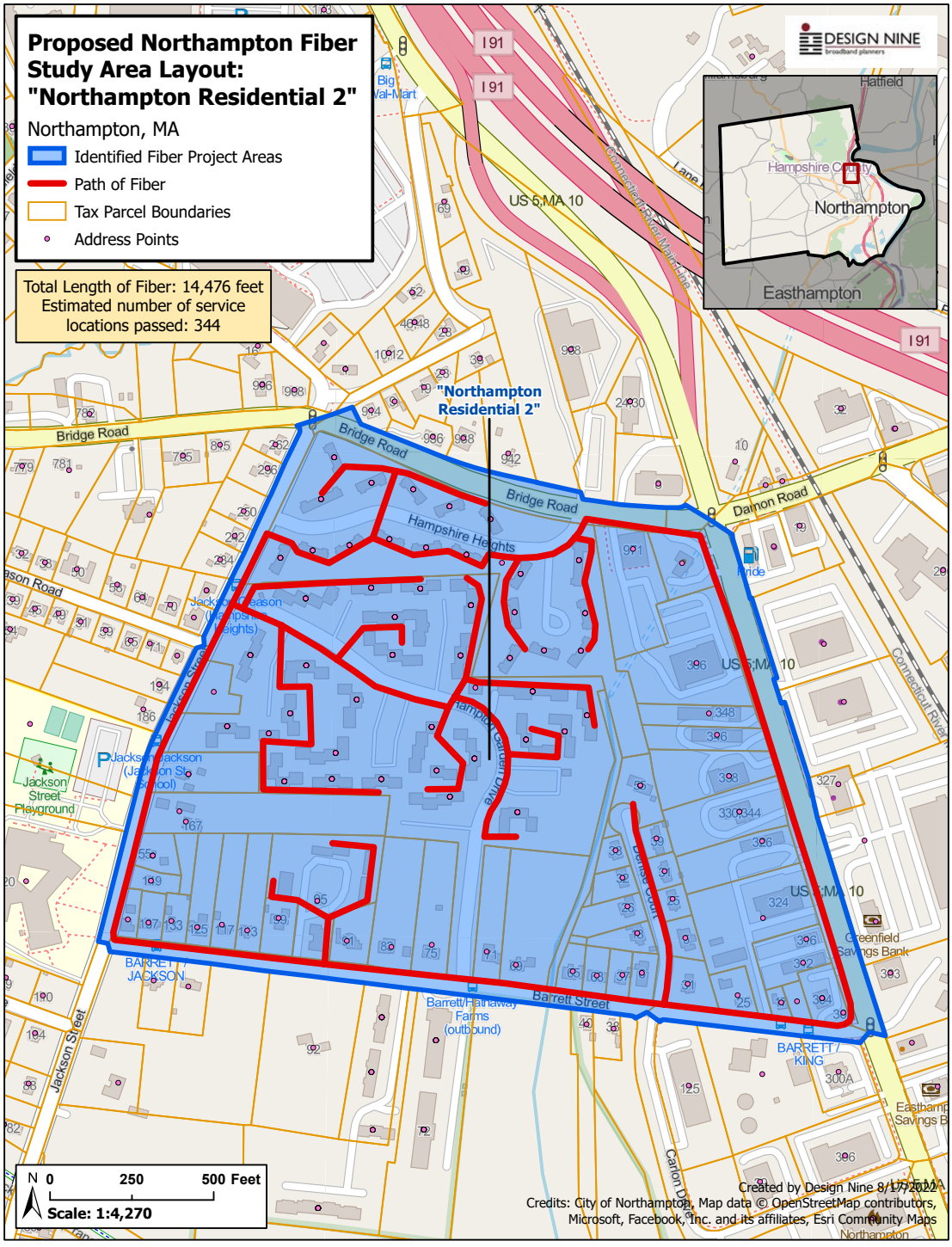
0	ITEM/PROJECT	VALUE
1	Miles of Fiber / Conduit Installed	0.97
2	Number of Handholes Installed	13
3	Splice Closures Installed	45
4	Cabinets Installed	1
5	Number of Buildings Connected	134
6	Take Rate - Percentage of the Buildings Passed who are connected	35%
7	Aerial - Percentage of construction expected to be installed on utility poles.	2%
8	Trenching - Percentage of construction installed by trenching	5%
9	Boring - Percentage of construction installed by horizontal drilling.	63%
10	Slot Cutting - Conduit installed in street by special methods.	0%
11	Rock Saw - Required where rock prevents the use of other methods.	0%
12	Direct Bury - Conduit installed by direct bury methods (plow, vibratory plow)	30%
13	Aerial Info	2% Aerial is estimated to account for water body crossings and other obstacles to construction.
14	Other Notes	Estimated labor rates are based upon common rates seen for recent medium sized rural projects.

Northampton Fiber Pilot - Northampton Residential 1 Cost Summary

0	ITEM/PROJECT	ESTIMATED
1	Northampton Residential 1 Construction Materials	$67,429
2	Northampton Residential 1 Distribution Labor	$150,580
3	Northampton Residential 1 Structures, Cabinets, and Equipment	$67,805
4	Northampton Residential 1 Drop Construction	$117,725
5	Network Construction Subtotal	**$403,539**
6	Project Mgmt, Network Engineering, Integration, and Testing	$72,637
7	Misc Fees, Advertising, Technical Services	$4,035
8	Bookkeeping and Administration	$3,027
9	Engineering, Permitting	$8,451
10	Legal Costs	$4,035
11	Other Costs Subtotal	$92,185
12	Project Total	**$495,725**
13	Contingency at 5%	$24,786
14	Project Total (with contingency)	**$520,511**

3.4 STUDY AREA 4: NORTHAMPTON RESIDENTIAL TWO

This area of the city includes a mix of single family homes and some apartment buildings.



Northampton Fiber Study Area - Northampton Residential 2 Route Overview

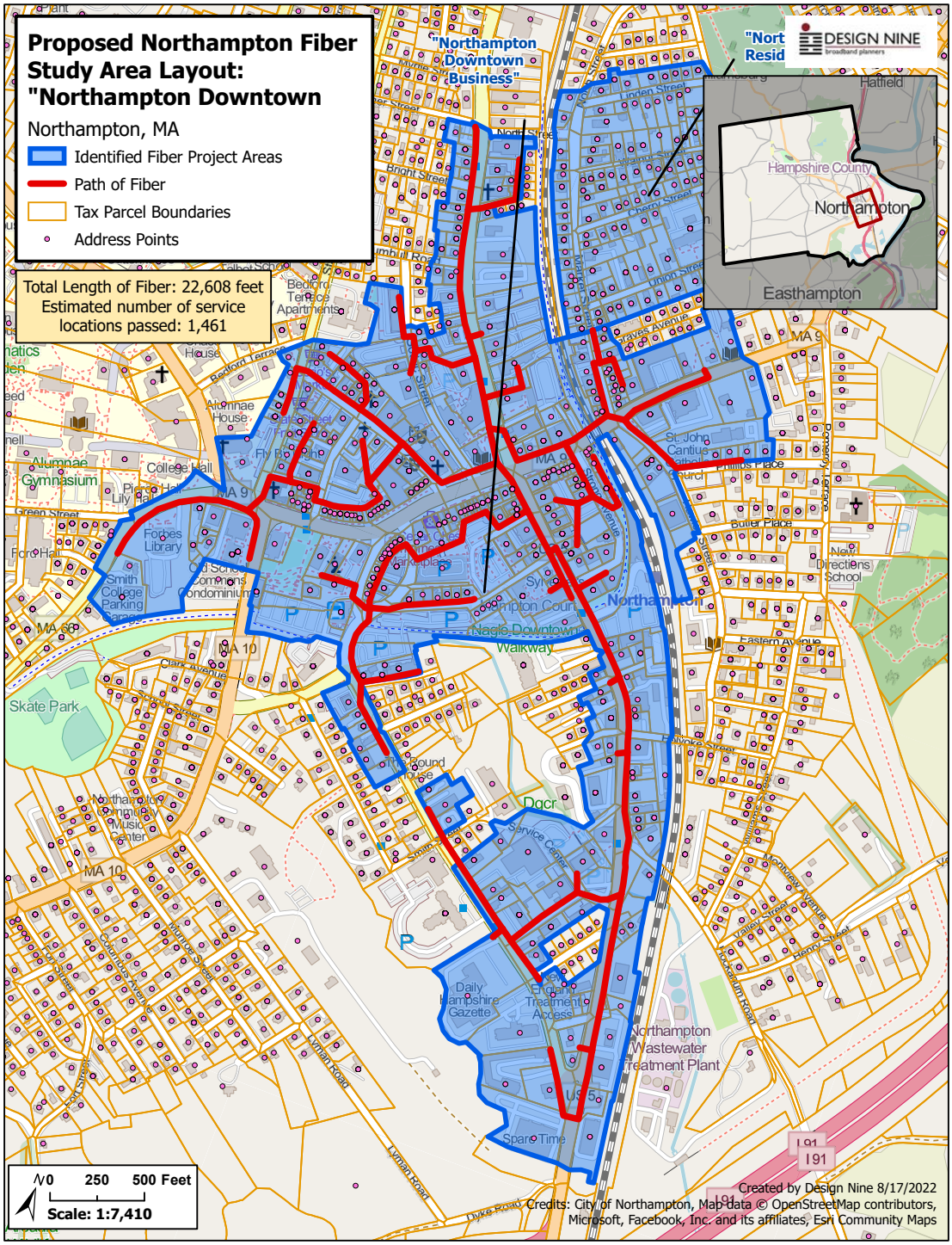
0	ITEM/PROJECT	VALUE
1	Miles of Fiber / Conduit Installed	2.75
2	Number of Handholes Installed	37
3	Splice Closures Installed	26
4	Cabinets Installed	1
5	Number of Buildings Connected	155
6	Take Rate - Percentage of the Buildings Passed who are connected	45%
7	Aerial - Percentage of construction expected to be installed on utility poles.	2%
8	Trenching - Percentage of construction installed by trenching	5%
9	Boring - Percentage of construction installed by horizontal drilling.	63%
10	Slot Cutting - Conduit installed in street by special methods.	0%
11	Rock Saw - Required where rock prevents the use of other methods.	0%
12	Direct Bury - Conduit installed by direct bury methods (plow, vibratory plow)	30%
13	Aerial Info	2% Aerial is estimated to account for water body crossings and other obstacles to construction.
14	Other Notes	Estimated labor rates are based upon common rates seen for recent medium sized projects.

Northampton Fiber Pilot - Northampton Residential 2 Cost Summary

0	ITEM/PROJECT	ESTIMATED
1	Northampton Residential 2 Construction Materials	$146,609
2	Northampton Residential 2 Distribution Labor	$306,957
3	Northampton Residential 2 Structures, Cabinets, and Equipment	$92,780
4	Northampton Residential 2 Drop Construction	$104,963
5	Network Construction Subtotal	**$651,309**
6	Project Mgmt, Network Engineering, Integration, and Testing	$117,236
7	Misc Fees, Advertising, Technical Services	$6,513
8	Bookkeeping and Administration	$4,885
9	Engineering, Permitting	$23,958
10	Legal Costs	$6,513
11	Other Costs Subtotal	$159,105
12	Project Total	**$810,413**
13	Contingency at 5%	$40,521
14	Project Total (with contingency)	**$850,934**

3.5 STUDY AREA 5: NORTHAMPTON DOWNTOWN BUSINESS

The downtown area will require a more complex fiber cable layout because of the high density of buildings.



Northampton Fiber Study Area - Northampton Downtown Business Route Overview

0	ITEM/PROJECT	VALUE
1	Miles of Fiber / Conduit Installed	4.29
2	Number of Handholes Installed	57
3	Splice Closures Installed	256
4	Cabinets Installed	1
5	Number of Buildings Connected	512
6	Take Rate - Percentage of the Buildings Passed who are connected	35%
7	Aerial - Percentage of construction expected to be installed on utility poles.	2%
8	Trenching - Percentage of construction installed by trenching	5%
9	Boring - Percentage of construction installed by horizontal drilling.	63%
10	Slot Cutting - Conduit installed in street by special methods.	0%
11	Rock Saw - Required where rock prevents the use of other methods.	0%
12	Direct Bury - Conduit installed by direct bury methods	30%
13	Aerial Info	2% Aerial is estimated to account for water body crossings and other obstacles to construction.
14	Other Notes	Estimated labor rates are based upon common rates seen for recent medium sized rural projects.

Northampton Fiber Pilot - Northampton Downtown Business Cost Summary

0	ITEM/PROJECT	ESTIMATED
1	Construction Materials	$337,945
2	Distribution Labor	$676,284
3	Structures, Cabinets, and Equipment	$215,000
4	Drop Construction	$552,400
5	Network Construction Subtotal	**$1,781,629**
6	Project Mgmt, Network Engineering, Integration, and Testing	$320,693
7	Misc Fees, Advertising, Technical Services	$17,816
8	Bookkeeping and Administration	$13,362
9	Engineering, Permitting	$37,374
10	Legal Costs	$17,816
11	Other Costs Subtotal	$407,062
12	Project Total	**$2,188,691**
13	Contingency at 5%	$109,435
14	Project Total (with contingency)	**$2,298,126**

4 CITYWIDE FINANCIAL ANALYSIS

4.1 OVERVIEW OF THE FINANCIAL PRO FORMA

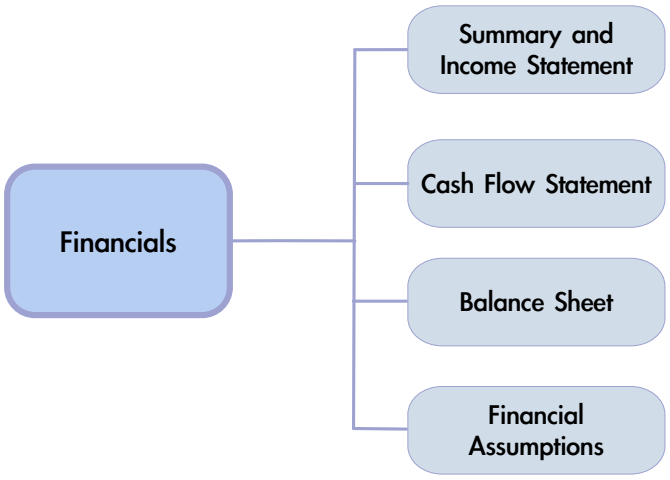
To provide a complete cost analysis, including organizational requirements, customer service, marketing, capital expenses, operating expenses, staffing, any debt costs, and direct and indirect costs, a ten year pro forma was developed. The pro forma provides a ten year financial projection for an open access lit network. In this model, the City would NOT be an Internet Service Provider, but instead would lease lit capacity on the network to ISPs. The ISPs would be responsible for marketing to and acquiring their own customers and handling all end user customer support.

There are four major sections in the pro forma.

- Financials
- Market Information
- Opex (Operating Expenditures)
- Capex Summary (Capital Expenditures)

4.2 FINANCIALS

The Financials section provides a high level overview of the entire set of financial projections, including a one page summary (the Income Statement) that shows key projections for revenue,



expenses, interest payments, and capital expenses over a ten year period.

The Cash Flow Statement and Balance Sheet are designed to provide financial information in a standard accounting format similar to any other business financial statement.

The Financial Assumptions table is an important area of the pro forma because key assumptions are made here that have large effects on the overall projections. These assumptions include:

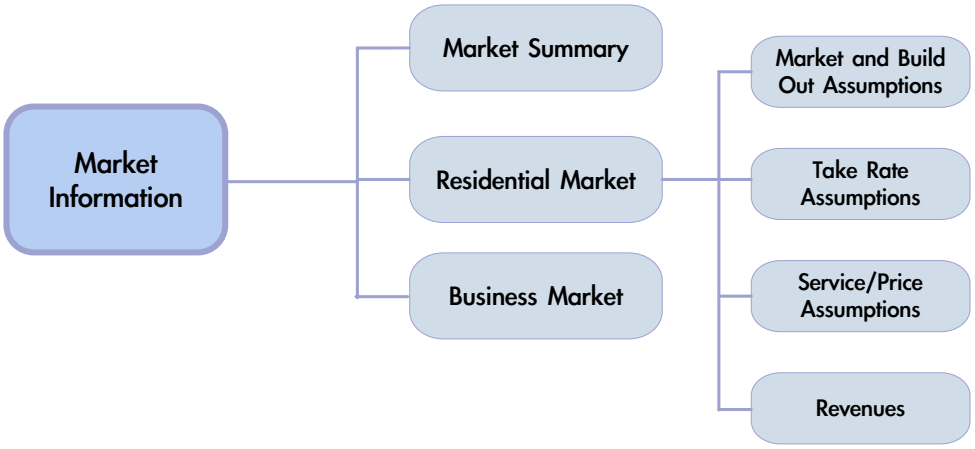
- The amount of debt vs. equity that the project takes on, year by year.
- Interest paid on cash on hand

- Calculations on up to five loans, including interest, principal, and loan balances, and the option to make interest only payments for a period of years.

The Financial section has the ability to calculate the carrying costs of up to five separate loans, including fees and closing costs, interest payments, principal payments, and deferred interest (e.g. no interest for the first two years).

4.3 MARKET INFORMATION

This section forecasts revenue, market size, take rates, services, and service prices for three separate market segments: residential, business, and government. Each market segment tends to have different service and pricing requirements, and breaking services and projections out by market provides a more accurate and more detailed projection of revenue.

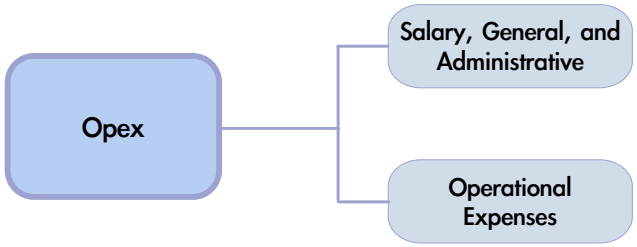


Each market segment is organized similarly, with four key sections.

- Market Assumptions includes the projected size of the market, year by year growth in the size of the market, and the take rate assumptions for that market. The term "available market" refers to the actual number of connected customers that could purchase a service. "Homes Passed" refers to homes that have been passed by fiber and could buy service. The "Take Rate" is the percentage of Homes Passed that actually get connected and do buy services from the network. The term "addressable market" refers to the locations that actually purchase a service as a percentage of the entire market.
- Monthly Cost of Service is the fee paid by connected homes in the Residential market.
- In the Business/Institutional market, Services (Monthly) are the services offered to those users and the projected prices for those services provided on a wholesale basis to one or more service providers. Note that these are projections, and that once the network is built, some price adjustments may be made based on feedback from providers. These pro forma prices are a projection based on markets and prices from other networks and from data collected locally.
- The Annual Revenue provides projections of revenue by service, by year.

4.4 OPEX

The Operational Expenses section has two parts. Salary, General, and Administrative (SG&A) projects expenses that are relatively independent of the size of the network, although this is only a rough rule of thumb. Costs like staff and marketing do tend to grow over time as the network expands. The Operational Expense table projects expenses that are more tightly linked to the growth of the network.



Some of the SG&A costs tracked include:

- Staff costs, including salary, benefits, and staff-related expenses like travel, phone/Internet access, and miscellaneous overhead.
- General office expenses, including office supplies, computer supplies (e.g. ink, paper, toner), and shipping and postage.
- Marketing expenses, which are typically calculated based on the growth in customers.
- Other expenses, including legal counsel, consultants, insurance, and miscellaneous costs.

Operating expenses include:

- Support Fees, which are related to the cost of extended warranties for equipment and allocations for space parts, as well as software license fees.
- Network Operations Costs, which include any OSS/BSS software per subscriber fees, the cost of contracted network operations, and other infrastructure-related expenses.
- Outside Plant Maintenance, which budgets maintenance costs for fiber and wireless assets (e.g. fiber cable, handholes, cabinets, wireless towers, etc.).

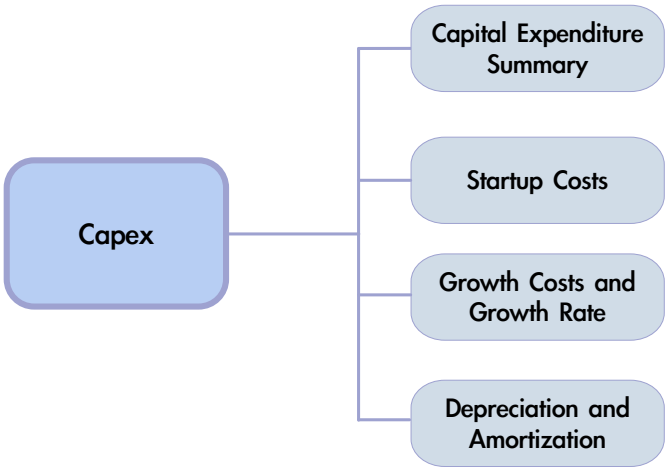
Note that at the bottom of the Operating Expenses table, there is a row that calculates the operational costs on a per subscriber basis. In the early years of a project, it is likely that this projected amount is higher than the ARPU amount. But if the two projected figures do not converge in later years, then more customers need to be added to the network, the pricing needs to be adjusted, and/or costs need to be reduced.

4.5 CAPITAL EXPENDITURES

This section models the cost of construction of the network.

Capital Expenditure Summary

The Capital Expenditure Summary (Capex) table provides a summary of the costs associated with the construction of the network. A summary of the depreciation and amortization costs are also included. Most fiber and outside plant assets can be depreciated over thirty years. Most equipment is depreciated on a much shorter time schedule of five to seven years, and a few items like software are typically amortized over a three to five year time frame.



Startup Costs

The assumptions on this page provide costs for outside plant (e.g. fiber cable, duct, handholes, shelters and cabinets, data center, etc.), equipment costs (e.g. fiber switches, routers, power supplies, CPE, etc.), and the other professional services needed to get the network built (engineering, project management, legal, specialty consulting, software, etc).

Growth Costs and Growth Rate

The Growth Cost table is similar to the Startup Cost table in format. However, it is driven by a complex set of formulas that allow year by year take rate and new construction projections. Those projections calculate the costs associated with overall growth of the network.

Depreciation and Amortization Schedule

The depreciation schedules allow for separate depreciation of active and passive assets, including adjusting the term of each schedule in years. Passive assets are typically depreciated for at least twenty years, and active assets like network electronics are depreciated for a much shorter time (e.g. five years). An amortization schedule allows for a write down of "soft" assets like software licenses.

4.6 INCOME STATEMENT

The Income Statement summarizes the performance of the proposed project over a ten year time span. The network has the potential to generate revenue beginning in year four, and by year four, some funds could be returned to the City General Fund and/or some service fees could be reduced.

Northampton Income Statement and Financial Summary

Summary of Project Revenue	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**
Residential Recurring Revenue	$65,205	$619,731	$1,475,334	$2,409,625	$2,969,107	$3,206,758	$3,268,716	$3,431,213	$3,495,029	$3,559,465
Business/Inst. Recurring Revenue	$0	$23,786	$60,653	$98,072	$137,546	$180,382	$244,521	$300,098	$329,489	$345,286
Residential Annual Non-Recurring	$34,931	$151,369	$154,305	$154,305	$39,589	$10,429	$10,530	$10,429	$10,530	$10,429
Business/Inst. Non-Recurring	$0	$11,700	$5,850	$5,850	$9,506	$6,581	$11,700	$6,728	$1,609	$1,609
Total Recurring Revenue	$65,205	$643,517	$1,535,987	$2,507,697	$3,106,653	$3,387,140	$3,513,237	$3,731,311	$3,824,518	$3,904,751
Total Non-Recurring Revenue	$34,931	$163,069	$160,155	$160,155	$49,095	$17,010	$22,230	$17,156	$12,139	$12,038
Total Other Services	$5,306	$52,626	$125,544	$199,975	$247,777	$262,946	$271,524	$280,550	$287,214	$292,751
Gross Network Revenue	**$105,442**	**$859,212**	**$1,821,686**	**$2,867,827**	**$3,403,525**	**$3,667,096**	**$3,806,991**	**$4,029,017**	**$4,123,871**	**$4,209,540**
Cost of Services	$207,925	$487,558	$595,826	$689,528	$749,329	$767,706	$794,977	$823,336	$852,294	$882,215
Gross Profit	-$102,483	$371,654	$1,225,860	$2,178,299	$2,654,196	$2,899,389	$3,012,014	$3,205,681	$3,271,577	$3,327,325
Gross Margin	-97.2%	43.3%	67.3%	76.0%	78.0%	79.1%	79.1%	79.6%	79.3%	79.0%
Sales, General & Admin Expenses	$247,515	$545,142	$573,864	$669,845	$578,190	$573,396	$593,598	$609,680	$624,317	$639,416
EBITDA	**-$349,998**	**-$173,488**	**$651,996**	**$1,508,454**	**$2,076,007**	**$2,325,993**	**$2,418,416**	**$2,596,001**	**$2,647,260**	**$2,687,909**
Interest Income	$0	$3,403	$1,036	$1,044	$463	$1,875	$6,064	$10,019	$14,656	$19,533
Interest Expense	$0	$280,000	$525,000	$682,500	$700,000	$691,339	$674,797	$652,274	$628,362	$603,614
Taxes	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Depreciation	$0	$103,505	$411,143	$682,584	$952,196	$1,011,682	$1,018,828	$1,026,032	$1,033,248	$1,040,395
Amortization	$0	$12,614	$14,408	$16,236	$18,066	$18,535	$5,921	$4,127	$2,424	$718
Net Income	**-$349,998**	**-$566,204**	**-$297,519**	**$128,178**	**$406,208**	**$606,313**	**$724,935**	**$923,587**	**$997,882**	**$1,062,715**
Cash-On-Hand at Year End	**$816,626**	**$248,544**	**$250,493**	**$111,206**	**$450,064**	**$1,455,344**	**$2,404,556**	**$3,517,513**	**$4,687,867**	**$5,903,864**
Capital Expenditures (CAPEX)	$2,871,329	$8,166,101	$7,137,499	$6,082,092	$1,537,500	$159,740	$160,916	$161,310	$159,740	$159,740
Accumulated CAPEX	$2,871,329	$11,037,430	$18,174,929	$24,257,021	$25,794,521	$25,954,261	$26,115,177	$26,276,487	$26,436,227	$26,595,967
Summary of Funding and Borrowing										
Sources of Funds	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**
Equity	$4,000,000	$0	$0	$600,000	$250,000	$0	$0	$0	$0	$0
Long-Term Debt	$0	$8,000,000	$7,000,000	$4,500,000	$500,000	$0	$0	$0	$0	$0
Total Funding	**$4,000,000**	**$8,000,000**	**$7,000,000**	**$5,100,000**	**$750,000**	**$0**	**$0**	**$0**	**$0**	**$0**

4.7 CAPITAL EXPENSES

The build out of the network is estimated to take approximately three years. Little or no construction will be able to take place in the winter months. By year four, revenue could be sufficient to fund all future expansion with additional capital funds or debt.

Capital Expenditure (CAPEX) Summary

Outside Plant	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Project Specials / TBD	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Buildings	$81,840	$27,720	$22,440	$0	$0	$0	$0	$0	$0	$0
Distribution	$1,553,850	$4,656,150	$3,881,250	$3,105,000	$777,600	$0	$0	$0	$0	$0
Access	$429,540	$1,860,800	$1,895,815	$1,897,940	$486,920	$128,270	$129,130	$129,535	$128,270	$128,270
Subtotal	**$2,065,230**	**$6,544,670**	**$5,799,505**	**$5,002,940**	**$1,264,520**	**$128,270**	**$129,130**	**$129,535**	**$128,270**	**$128,270**
Equipment										
Core / Routing	$33,883	$101,587	$84,661	$67,735	$16,957	$0	$0	$0	$0	$0
Distribution / Switching	$27,600	$119,600	$121,840	$122,000	$31,280	$8,240	$8,320	$8,320	$8,240	$8,240
CPE	$51,750	$224,250	$228,450	$228,750	$58,650	$15,450	$15,600	$15,600	$15,450	$15,450
Other (servers, etc.)	$14,000	$14,000	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal	**$127,233**	**$459,437**	**$434,951**	**$418,485**	**$106,887**	**$23,690**	**$23,920**	**$23,920**	**$23,690**	**$23,690**
Other										
Professional Services	$280,266	$512,174	$398,762	$290,470	$72,994	$3,090	$3,120	$3,120	$3,090	$3,090
Engineering	$193,628	$389,385	$325,871	$234,525	$59,007	$3,296	$3,328	$3,328	$3,296	$3,296
Legal	$13,750	$9,075	$4,675	$0	$0	$0	$0	$0	$0	$0
OSS/BSS/Software	$63,070	$8,970	$9,138	$9,150	$2,346	$618	$624	$624	$618	$618
Vehicles and Tools	$40,500	$40,500	$0	$0	$0	$0	$0	$0	$0	$0
Other Upfront Costs	$87,652	$201,890	$164,597	$126,522	$31,746	$776	$794	$783	$776	$776
Subtotal	**$678,866**	**$1,161,994**	**$903,043**	**$660,667**	**$166,093**	**$7,780**	**$7,866**	**$7,855**	**$7,780**	**$7,780**
TOTAL CAPITAL EXPENDITURES	**$2,871,329**	**$8,166,101**	**$7,137,499**	**$6,082,092**	**$1,537,500**	**$159,740**	**$160,916**	**$161,310**	**$159,740**	**$159,740**
30 Year Depreciation Capex	$2,681,026	$7,697,694	$6,693,410	$5,654,457	$1,428,267	$135,432	$136,372	$136,766	$135,432	$135,432
9 Year Depreciation Capex	$127,233	$459,437	$434,951	$418,485	$106,887	$23,690	$23,920	$23,920	$23,690	$23,690
7 Year Amortization Capex	$63,070	$8,970	$9,138	$9,150	$2,346	$618	$624	$624	$618	$618

4.8 RESIDENTIAL FIBER MARKET ASSUMPTIONS

The model assumes that all homes and businesses that request service would receive service, but there will always be some locations that never take service. So the build is projected to pass 90% of premises, with a final take rate of 60% (there will be some premises that will choose to stay with the incumbent providers).

Residential Fiber Market and Build Out Assumptions

Detached & Single House (SDU): 95% | Apartments: 5%

Market Assumptions		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Total Available Market	11,500	10%	40%	65%	85%	90%	90%	90%	90%	90%	90%
Homes Passed		**1150**	**4600**	**7475**	**9775**	**10350**	**10350**	**10350**	**10350**	**10350**	**10350**
Take Rate		30%	40%	45%	50%	51%	52%	53%	54%	55%	56%
Homes that purchase service(s)		**345**	**1840**	**3364**	**4888**	**5279**	**5382**	**5486**	**5589**	**5693**	**5796**
Addressable Market %		3%	16%	29%	43%	46%	47%	48%	49%	50%	50%
Fiber Optic Build Out											
New customers		345	1495	1524	1524	391	103	104	103	104	103
Average customers this year		**115**	**1093**	**2602**	**4126**	**5084**	**5331**	**5434**	**5538**	**5641**	**5745**
Year end		345	1840	3364	4888	5279	5382	5486	5589	5693	5796
Non-recurring Revenue											
Network Activation Fee	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Deposits	$45	$14,749	$63,911	$65,151	$65,151	$16,715	$4,403	$4,446	$4,403	$4,446	$4,403
SDU Construction Fee	$100	$18,026	$78,114	$79,629	$79,629	$20,430	$5,382	$5,434	$5,382	$5,434	$5,382
MDU construction Fee	$125	$2,156	$9,344	$9,525	$9,525	$2,444	$644	$650	$644	$650	$644
Total Non-Recurring Revenue		**$34,931**	**$151,369**	**$154,305**	**$154,305**	**$39,589**	**$10,429**	**$10,530**	**$10,429**	**$10,530**	**$10,429**
Monthly Cost of Service		***Price Index***	***0%***	***0%***	***3%***	***0%***	***3%***	***0%***	***3%***	***0%***	***0%***
Standard Transport Monthly Fee	$45	$45	$45	$45	$46	$46	$48	$48	$49	$49	$49
Total Transport Monthly Fee		**$62,100**	**$590,220**	**$1,405,080**	**$2,294,881**	**$2,827,721**	**$3,054,055**	**$3,113,063**	**$3,267,822**	**$3,328,599**	**$3,389,967**
Growth in Advanced Services	5%	$3,105	$29,511	$70,254	$114,744	$141,386	$152,703	$155,653	$163,391	$166,430	$169,498
Take Rate Per Service											
100/100	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
250/250	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%
500/500	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
1G/1G	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
2G/2G	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%
Check Sum	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*
Annual Revenues											
Non-recurring - Construction Fees		$34,931	$151,369	$154,305	$154,305	$39,589	$10,429	$10,530	$10,429	$10,530	$10,429
Recurring - Monthly Transport & Growth Fees		$65,205	$619,731	$1,475,334	$2,409,625	$2,969,107	$3,206,758	$3,268,716	$3,431,213	$3,495,029	$3,559,465
Total Revenue Before Expenses		**$100,136**	**$771,100**	**$1,629,639**	**$2,563,930**	**$3,008,696**	**$3,217,187**	**$3,279,246**	**$3,441,642**	**$3,505,559**	**$3,569,894**

4.9 BUSINESS MARKET ASSUMPTIONS

The business market is more limited than the residential market. Many businesses are locked into long term contracts, and others have contracts negotiated by corporate IT and are not allowed to change. Nonetheless, business revenue can still make an important contribution.

Business/Institutional Market and Build Out Assumptions

Market Assumptions		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Total Available Market	450	5%	10%	15%	20%	25%	30%	35%	36%	37%	38%
Businesses Passed		23	45	68	90	113	135	158	162	167	171
Take Rate		0%	40%	40%	40%	45%	45%	50%	55%	55%	55%
Businesses Serviced		0	18	27	36	51	61	79	89	92	94
Addressable Market %		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Fiber Optic Build Out											
New fiber customers		0	18	9	9	15	10	18	10	2	2
Average customers per year		**0**	**9**	**23**	**32**	**43**	**56**	**70**	**84**	**90**	**93**
Year end		0	18	27	36	51	61	79	89	92	94
Monthly Cost of Services	*WON$*	*Price Index*	*0%*	*2%*	*2%*	*2%*	*2%*	*2%*	*2%*	*2%*	*2%*
Business GPON 1000/250 Mbps	$85	$85	$85	$87	$88	$90	$92	$94	$96	$98	$100
Business GPON 1000/500 Mbps	$115	$115	$115	$117	$120	$122	$124	$127	$130	$132	$135
Dedicated Business 250/250 Mbps	$210	$210	$210	$214	$218	$223	$227	$232	$236	$241	$246
Dedicated Business 500/500 Mbps	$285	$285	$285	$291	$297	$302	$308	$315	$321	$327	$334
Dedicated Business 1G/1G	$375	$375	$375	$383	$390	$398	$406	$414	$422	$431	$439
Wide Area LAN Service 250/250 Mbps	$375	$375	$375	$383	$390	$398	$406	$414	$422	$431	$439
Wide Area LAN Service 500/500 Mbps	$455	$455	$455	$464	$473	$483	$493	$502	$512	$523	$533
Wide Area LAN Service 1G/1G	$675	$675	$675	$689	$702	$716	$731	$745	$760	$775	$791
Take Rate Per Service											
Business GPON 1000/250 Mbps		35%	25%	25%	20%	20%	20%	15%	15%	15%	15%
Business GPON 1000/500 Mbps		25%	30%	30%	20%	20%	20%	20%	20%	20%	20%
Dedicated Business 250/250 Mbps		10%	15%	15%	20%	20%	20%	20%	20%	20%	20%
Dedicated Business 500/500 Mbps		10%	10%	10%	15%	15%	15%	15%	15%	15%	15%
Dedicated Business 1G/1G		5%	5%	5%	10%	10%	10%	10%	10%	10%	10%
Wide Area LAN Service 250/250 Mbps		5%	5%	5%	5%	5%	5%	10%	10%	10%	10%
Wide Area LAN Service 500/500 Mbps		5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Wide Area LAN Service 1G/1G		5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
	Check Sum	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*
Non-recurring Revenue											
Network Activation Fee	$150	$0	$2,700	$1,350	$1,350	$2,194	$1,519	$2,700	$1,553	$371	$371
Business Construction Fee	$500	$0	$9,000	$4,500	$4,500	$7,313	$5,063	$9,000	$5,175	$1,238	$1,238
Annual Non-recurring Revenue		$0	$11,700	$5,850	$5,850	$9,506	$6,581	$11,700	$6,728	$1,609	$1,609
Annual Recurring Revenue		$0	$23,786	$60,653	$98,072	$137,546	$180,382	$244,521	$300,098	$329,489	$345,286
Business Revenue Before Expenses		**$0**	**$35,486**	**$66,503**	**$103,922**	**$147,052**	**$186,963**	**$256,221**	**$306,826**	**$331,097**	**$346,895**

4.10 GENERAL AND ADMINISTRATIVE EXPENSES

General and Administrative expenses include staff costs, office costs, some marketing and awareness costs, and other miscellaneous expenses.

General & Administrative (G&A) Expenses

Benefits: 25% | Annual Salary Increase: 3%

		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Staff Salaries and Benefits											
Manager	# of Emp	0.50	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Salary	$75,000	$46,875	$96,563	$99,459	$102,443	$105,516	$108,682	$111,942	$115,301	$118,760	$122,322
Finance and Billing		0.50	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Salary	$55,000	$34,375	$70,813	$72,937	$75,125	$77,379	$79,700	$82,091	$84,554	$87,090	$89,703
Customer Service		0.50	1.00	1.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Salary	$42,000	$26,250	$54,075	$55,697	$114,736	$118,178	$121,724	$125,375	$129,137	$133,011	$137,001
Total Staff Salary and Benefits		**$107,500**	**$221,450**	**$228,094**	**$292,304**	**$301,074**	**$310,106**	**$319,409**	**$328,991**	**$338,861**	**$349,027**
Total # of Admin Employees		1.5	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Total # of Technical Employees		2.5	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Total # of Employees		**4.0**	**8.0**	**8.0**	**9.0**	**9.0**	**9.0**	**9.0**	**9.0**	**9.0**	**9.0**
Staff and Office Expenses											
Travel Expenses	$2,000	$3,000	$6,000	$6,000	$8,000	$8,000	$8,000	$8,000	$8,000	$8,000	$8,000
Other Management fees	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Other staff costs	$2,500	$10,000	$20,000	$20,000	$22,500	$22,500	$22,500	$22,500	$22,500	$22,500	$22,500
Office and Expenses		$24,000	$24,480	$24,970	$25,469	$25,978	$26,498	$27,028	$27,568	$28,120	$28,682
Office Supplies		$8,500	$8,925	$9,371	$9,840	$10,332	$10,848	$11,391	$11,960	$12,558	$13,186
Computers and Office Equipment		$5,000	$15,000	$10,000	$4,000	$4,000	$4,000	$7,500	$5,000	$5,000	$5,000
Mailing & Delivery	$10	$3,450	$14,950	$15,240	$15,240	$3,910	$1,030	$1,040	$1,030	$1,040	$1,030
Credit Card Fees	3.50%	$3,690	$30,072	$63,759	$100,374	$119,123	$128,348	$133,245	$141,016	$144,335	$147,334
Total Staff and Office Expenses		**$57,640**	**$119,427**	**$149,340**	**$185,423**	**$193,844**	**$201,225**	**$210,703**	**$217,074**	**$221,554**	**$225,732**
Sales/Marketing Commissions	$75.00	$25,875	$113,475	$114,975	$114,975	$30,422	$8,484	$9,150	$8,501	$7,986	$7,911
Marketing and Advertising		$42,000	$65,000	$55,000	$50,000	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000
Total Marketing Expense		**$67,875**	**$178,475**	**$169,975**	**$164,975**	**$55,422**	**$33,484**	**$34,150**	**$33,501**	**$32,986**	**$32,911**
Other External Expenses											
Law & Audit		$0	$6,000	$6,120	$6,242	$6,367	$6,495	$6,624	$6,757	$6,892	$7,030
Financial & Technical Consulting		$0	$5,000	$5,250	$5,513	$5,788	$6,078	$6,381	$6,700	$7,036	$7,387
Asset, Business, Liability Insurance		$4,500	$4,590	$4,682	$4,775	$4,871	$4,968	$5,068	$5,169	$5,272	$5,378
Miscellaneous		$10,000	$10,200	$10,404	$10,612	$10,824	$11,041	$11,262	$11,487	$11,717	$11,951
Total Other External Expenses		**$14,500**	**$25,790**	**$26,456**	**$27,142**	**$27,851**	**$28,581**	**$29,335**	**$30,113**	**$30,917**	**$31,746**
Total SG&A Expenses		**$247,515**	**$545,142**	**$573,864**	**$669,845**	**$578,190**	**$573,396**	**$593,598**	**$609,680**	**$624,317**	**$639,416**

4.11 OPERATIONS EXPENSES

Operations Expenses are more directly tied to the growth of the customer base. As more subscribers are added to the network, costs for certain categories can increase incrementally.

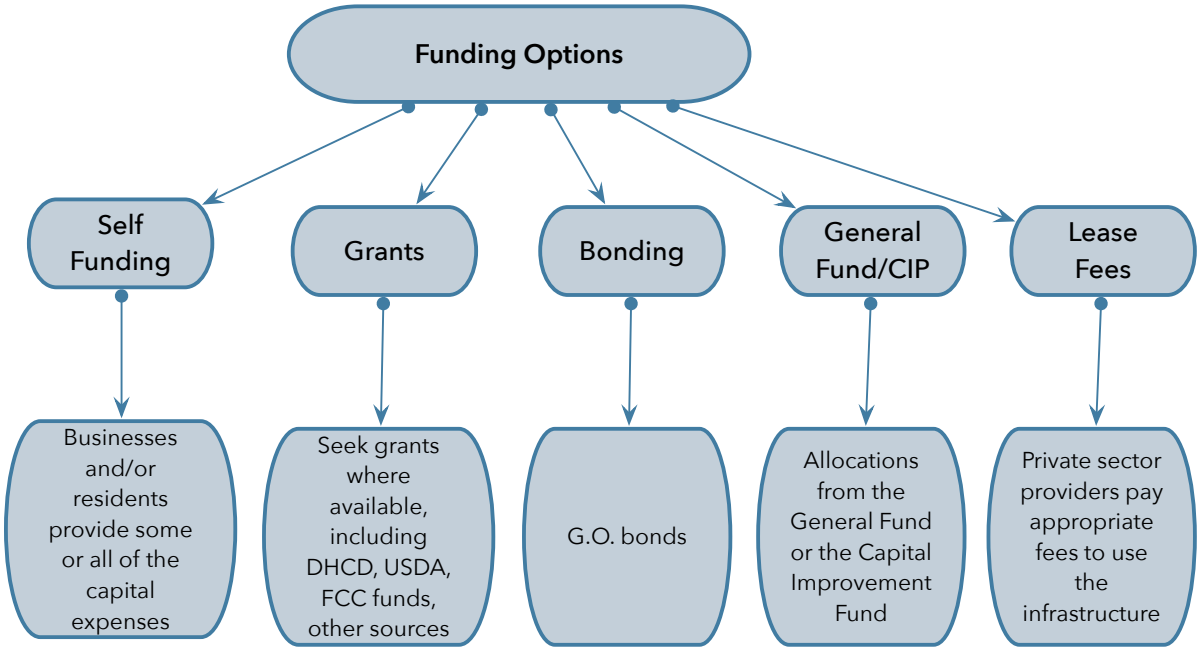
Service Delivery and Network Operations

		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Service Delivery Staff		0.50	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Technical Services Manager	$65,000	$40,625	$83,688	$86,198	$88,784	$91,448	$94,191	$97,017	$99,927	$102,925	$106,013
		1.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Network Technician	$55,000	$68,750	$141,625	$145,874	$150,250	$154,757	$159,400	$164,182	$169,108	$174,181	$179,406
		1.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Service Delivery Technician	$42,000	$52,500	$108,150	$111,395	$114,736	$118,178	$121,724	$125,375	$129,137	$133,011	$137,001
Total Service Delivery Staff Salary and Benefits		**$161,875**	**$333,463**	**$343,466**	**$353,770**	**$364,383**	**$375,315**	**$386,574**	**$398,172**	**$410,117**	**$422,420**
Support and Equip. Replacement Fees											
Core Network Equipment		$0	$6,000	$6,300	$6,615	$6,946	$7,293	$7,658	$8,041	$8,443	$8,865
Distribution Network Equipment		$0	$6,500	$6,825	$7,166	$7,525	$7,901	$8,296	$8,711	$9,146	$9,603
CPE		$0	$6,000	$6,600	$7,260	$7,986	$8,785	$9,663	$10,629	$11,692	$12,862
Billing System & Consumer Portal		$0	$9,000	$9,450	$9,923	$10,419	$10,940	$11,487	$12,061	$12,664	$13,297
Total Equipment Support Fees		**$0**	**$27,500**	**$29,175**	**$30,964**	**$32,875**	**$34,918**	**$37,103**	**$39,441**	**$41,945**	**$44,627**
Network Operations Costs											
Per Subscriber NOC/Support Fee		$ 3.00	$ 3.00	$ 3.00	$ 2.75	$ 2.50	$ 2.25	$ 2.25	$ 2.25	$ 2.25	$ 2.25
Per Subscriber NOC/Support Fee Total		$4,140	$39,672	$94,482	$137,198	$153,819	$145,441	$148,601	$151,792	$154,746	$157,621
Back office billing fees per Subscriber		$ 2.00	$ 2.00	$ 2.00	$ 2.06	$ 2.12	$ 2.19	$ 2.25	$ 2.32	$ 2.39	$ 2.46
Back office billing fees per Subscriber Total		$2,760	$26,448	$62,988	$102,773	$130,550	$141,268	$148,668	$156,416	$164,244	$172,315
Network Operations Base Fee		$18,000	$36,000	$37,080	$38,192	$39,338	$40,518	$41,734	$42,986	$44,275	$45,604
Number of Electric Service Locations		1	2	2	2	2	2	2	2	2	2
Electric Service Locations Total	$50	$600	$1,200	$1,200	$1,200	$1,200	$1,200	$1,200	$1,200	$1,200	$1,200
Locates		$3,000	$3,300	$3,630	$3,993	$4,392	$4,832	$5,315	$5,846	$6,431	$7,074
Pole Use Fees	$25	$1,250	$1,375	$1,513	$1,664	$1,830	$2,013	$2,214	$2,436	$2,679	$2,947
Conduit/Dark Fiber Lease		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Storage and Lay Lot		$4,800	$4,800	$4,800	$1,200	$1,200	$1,200	$1,200	$1,200	$1,200	$1,200
Tools and Equipment		$9,000	$9,450	$9,923	$10,419	$10,940	$11,487	$12,061	$12,664	$13,297	$13,962
Site Leases		$5,000	$5,150	$5,305	$5,464	$5,628	$5,796	$5,970	$6,149	$6,334	$6,524
Total Network Operational Costs		**$43,550**	**$122,245**	**$215,615**	**$296,639**	**$343,269**	**$347,958**	**$360,994**	**$374,540**	**$388,073**	**$401,922**
Outside Plant (OSP) Costs											
Outside Plant Maintenance		$2,500	$2,550	$5,500	$5,775	$6,064	$6,367	$6,685	$7,020	$7,371	$7,739
Building and Vehicle Maintenance		$0	$1,800	$2,070	$2,381	$2,738	$3,148	$3,620	$4,164	$4,788	$5,506
Total Outside Plant (OSP) Maintenance		**$2,500**	**$4,350**	**$7,570**	**$8,156**	**$8,801**	**$9,515**	**$10,306**	**$11,183**	**$12,159**	**$13,245**
Total Operational Expenses		**$207,925**	**$487,558**	**$595,826**	**$689,528**	**$749,329**	**$767,706**	**$794,977**	**$823,336**	**$852,294**	**$882,215**
Total SG&A and OPEX		**$455,440**	**$1,032,700**	**$1,169,691**	**$1,359,373**	**$1,327,519**	**$1,341,103**	**$1,388,574**	**$1,433,017**	**$1,476,611**	**$1,521,631**
Monthly Operational Cost per Sub		**$330**	**$78**	**$37**	**$27**	**$22**	**$21**	**$21**	**$21**	**$21**	**$22**

5 INFRASTRUCTURE FUNDING AND GRANT OPPORTUNITIES

It is important to note that any investment by City government in broadband infrastructure should be focused on passive infrastructure. Passive infrastructure can be leased to private sector service providers, generating long term revenue for maintenance and expansion. Leasing passive infrastructure like towers and dark fiber is not a "telecommunications service."

These assets will have a conservative life span of thirty years or more (e.g. wireless towers, conduit, fiber cable). These types of infrastructure investments create hard assets that have tangible value and can then be leveraged for additional borrowing. The demand for services and the associated fees paid for those services will provide the revenue that will pay back loans over time. There is ample time to recoup not only the initial capital investment, but also to receive regular income from the infrastructure.



The financing of local government and/or community-owned telecommunications infrastructure faces several challenges with respect to funding.

- Not all local governments are willing to commit to making loan guarantees from other funding sources like property taxes, because the idea of community-owned telecom infrastructure has a limited track record and therefore a higher perceived risk.
- Similarly, citizens are not always willing to commit to the possibility of broadband fees or higher taxes that may be needed to support a telecom infrastructure initiative, for many of the same reasons that local governments are still reluctant to make such commitments: perceived risk and a lack of history for such projects.

- Finally, banks and investors are also more skeptical of community telecom projects because of the relative newness of the phenomenon. By comparison, there are decades of data on the financial performance of water and sewer systems, so the perceived risk is lower.

Somewhat paradoxically, the cost of such a community digital road system is lower when there is a day one commitment to build to any residence or business that requests service. This maximizes the potential marketplace of buyers and attracts more sellers to offer services because of the larger potential market. This is so because:

- Service providers are reluctant to make a commitment to offer services on a network without knowing the total size of the market. A larger market, even if it takes several years to develop, is more attractive.
- Funding agencies and investors that may provide loans and grants to a community network project want to know how the funds will be repaid and/or that grants will contribute to a financially sustainable project. Knowing that the size of the customer base is the maximum possible for a service area helps reduce the perceived risk for providing loans and grants.

5.1 ARPA (AMERICAN RESCUE PLAN ACT) FUNDING

The American Rescue Plan Act of 2021, is the biggest federal funding program for broadband projects. ARPA has $350 billion in funding. Each state receives an ARPA fund allocation, and how much is targeted toward broadband initiatives will be decided by a state legislative committee and/or the governor of the state.

The 2020 CARES (Coronavirus Aid, Relief, and Economic Security Act) funding was typically distributed by state governments to localities (e.g. counties, towns, cities), which were then able to make decisions on how to spend the money within both the state and Federal guidelines attached to the funds.

ARPA funding has fewer requirements and "strings" attached than many other Federal broadband grant programs, and Northampton should make obtaining ARPA funds for city broadband projects a priority in late 2021 and early 2022.

5.2 HUD COMMUNITY DEVELOPMENT BLOCK GRANTS

The U.S. Housing and Urban Development CDBG State Program allows the Wisconsin state government to award grants to smaller units of general local government (e.g. counties, towns) that develop and preserve decent affordable housing, to provide services to the most vulnerable in our communities, and to create and retain jobs. In recent years, CDBG funds have been successfully used for broadband infrastructure development where the local government applicant can show the improvements meet the general guidelines of the program—so grant funds have to spent in low and moderate income areas.

Over a 1, 2, or 3-year period, as selected by the grantee, not less than 70 percent of CDBG funds must be used for activities that benefit low- and moderate-income persons. In addition, each activity must meet one of the following national objectives for the program: benefit low- and moderate-income persons, prevention or elimination of slums or blight, or address community development needs having a particular urgency because existing conditions pose a serious and immediate threat to the health or welfare of the community for which other funding is not available.

More information is available here (https://www.hud.gov/program_offices/comm_planning/communitydevelopment/programs).

5.3 911 FEES

Improved broadband access in the City can improve household access to 911 services by using broadband Internet to carry 911 voice calls, using one or more strategies to include:

WiFi calling – now a commonly available feature on new cell phones. WiFi calling switches voice telephone call from the cellular network to a nearby WiFi Internet network seamlessly. The reduces the need for additional large cell towers in low density areas of the City.

Nano-cell Devices – Nano-cells are a small box attached to a home wireless router. The nano-cell, which is typically obtained from the cellular provider, enables a cellphone to operate inside the home or business even if there is no cell tower near by.

A modest increase in the 911 fee to improve 911 access in rural areas of the City could generate funds to support additional broadband towers and community poles, but this approach would require legislative changes at the state level. See the tables later in this chapter for an example of how this might work (Section 5.11).

5.4 OPPORTUNITY ZONES

An Opportunity Zone is an economically-distressed community where new investments, under certain conditions, may be eligible for preferential tax treatment. Localities qualify as Opportunity Zones if they have been nominated for that designation by the state and that has been approved by the Internal Revenue Service. Opportunity Zones are designed to create tax incentives for private investors to make investments that can encourage economic development and job creation in distressed communities. Opportunity Zones would be of most use for Internet Service Providers who could use the tax benefits to make a business case to improve Internet access in a qualifying area (zone).

Opportunity Zones are defined by census tract, and the Census Bureau's Geocoder online tool can provide census tract ID numbers. A link to the list of currently qualified census tracts can be found on this page (https://www.cdfifund.gov/opportunity-zones). Northampton does have some designated Opportunity Zones.

5.5 BONDING

Revenue bonds are repaid based on the expectation of receiving revenue from the network, and do not obligate the local government or taxpayers if financial targets are not met. In that respect, they are different from general obligation bonds. Many kinds of regional projects (water, sewer, solid waste, etc.) are routinely financed with revenue bonds. We believe many community projects will eventually finance a significant portion of the effort with revenue bonds, but at the present time, the limited financing history of most community-owned broadband networks has limited using revenue bonds.

Selling revenue bonds for a start up municipal network can be more challenging because there is no financial or management history for the venture. Bond investors typically prefer to see two or three years of revenue and expenses and a track record of management success. It would be

advisable for the City to have an early conversation with qualified municipal bond counsel to assess the viability of this approach. ***However, the Covid crisis and the subsequent increase in demand for better broadband seems to encouraged the bond market to regard muni broadband financing as less risky than in past years.***

Obtaining funding using revenue bonds requires an excellent municipal credit rating and an investment quality financial plan for the operation and management of the network. Revenue bonds must be used carefully, and a well-designed financial model is required to show investors that sufficient cash flow exists to pay back the loans.

General obligation bonds are routinely used by local governments to finance municipal projects of all kinds. G.O. bonds are guaranteed by the good faith and credit of the local government, and are not tied to revenue generated by the project being funded (i.e. revenue bonds). G.O. bonds obligate the issuing government and the taxpayers directly, and in some cases could lead to increased local taxes to cover the interest and principal payments. Some bond underwriters have indicated a willingness to include telecom funds as part of a larger bond initiative for other kinds of government infrastructure (e.g. adding $1 million in telecom funds to a $10 million bond initiative for other improvements).

In discussions with bond underwriters, it has been suggested that it would be easier to obtain bond funds for telecom if the telecom bonding amount was rolled into a larger water or sewer bond, or some other type of bond request that are more familiar to the bond market.

5.6 RDOF/CAF2 FUNDING

The second round of the FCC Connect America Fund (CAF2) (Rural Digital Opportunity Fund) continues to provide funds to incumbent and competitive service providers. The funds must be used in unserved or underserved areas as defined by Federal census blocks. To be eligible, a census block could not have been served with voice and broadband of at least 10/1 Mbps (based on Form 477 data) by an unsubsidized competitor or price cap carrier.

The FCC published the final eligible census blocks for the auction on February 6, 2018. The final areas were based on FCC Form 477 data as of December 31, 2016 (the most recent publicly available FCC Form 477 data at the time). So there is a time lag between the determination of a qualifying census block or blocks and the schedule for submitting a bid to serve those areas. The first round of funding was announced in early 2021, and was immediately met with widespread criticism. SpaceX (Starlink) was awarded almost $900 million, and it may have to return some of those funds because the company appears to have included some ineligible census blocks. Many large incumbents also received substantial awards when some smaller ISPs that might have offered competition to the incumbents received much less or no funds.

Because many CAF2 qualifying areas are only served by low performance DSL (e.g. less than 10/1 Mbps service), incumbent carriers use the awards to upgrade DSL switches, which is not a long term solution. More recently, competitive carriers are applying for CAF2 funds to provide higher performance broadband wireless and in some cases fiber to the home. Because the use of CAF2 funds are so restricted, it has not had as much impact as many hoped. The FCC, as of fall 2021, has not announced the rules for the second round of funding.

5.7 LEASE FEES

Initiatives like tower access and access to local government-owned conduit and fiber can create long term revenue streams from lease fees paid by service providers using that infrastructure. The City of Danville, Virginia has recovered their entire initial capital investment from lease fees paid by providers on the nDanville fiber network.

5.8 COMMUNITY REINVESTMENT ACT

The Community Reinvestment Act (CRA) was developed forty years ago to encourage banks and savings institutions to help meet the credit needs of their local communities, with a focus on low and moderate income areas of those communities. The Federal agencies that oversee private banks assign a CRA rating to each institution. Banks are often looking for well-planned community efforts that need loans. Such loans can improve a bank's CRA rating.

The CRA was revised in 2016 to encourage banks to support community broadband efforts. A community broadband project may be able to get some loan financing from a local bank that wants to get credit for their CRA work.

5.9 CONNECTION FEES

Tap fees, pass by fees, and connection fees are already commonly used by local governments for utilities like water and sewer. The revenue share model can be strengthened from additional sources of revenue, including one time pass by fees, connection fees and sweat equity contributions. It is important to note that the Coop Membership Fee can be treated as a connection fee in whole or in part.

Pass By Fees – Pass by fees could be assessed once the fiber passes by the property, just as some communities assess a pass by fee when municipal water or sewer is placed in the road or street– and the fee is assessed whether or not the premise is connected, on the basis that the value of the property has been increased when municipal water or sewer service passes by. At least one study has indicated that properties with fiber connections have a higher value by $5,000 to $7,000 that similar properties without fiber access.

One Time Connection Fees – A one time connection fee can be assessed to property owners (e.g. residents and businesses) when the fiber drop from the street to the premise is installed. This is similar to the kinds of connection fees that are typically charged when a property is connected to a municipal water or sewer system. The fee is used to offset the cost of the fiber drop and the Customer Premise Equipment (CPE) needed to provide the operational access to the network. The connection fee can be modest (e.g. $100) or it can be a larger percentage of the actual cost of the connection. Fiber CPE may range from $250 to $350 and a fiber drop may cost from $200 for a premise very close to the distribution fiber passing along the property to $1,000 or more if the premise is hundreds of feet from the road. One variant would be to charge a minimum connection fee for up to some distance from the road (e.g. $100 for up to 75' and $2 for each additional foot).

There is already some data that indicates that residential property values increase by as much as $5,000 to $7,000 if fiber broadband services are available, so pass by fees can be justified on the basis of increased property values accruing to the property owner. Given the novelty of this approach, pass by fees may need more time to become an accepted finance approach, but tap

fees (for installing the fiber cable from the street or pedestal to the side of the home or business) may be easier to use, especially for businesses that may need improved broadband access. Tap fees have the potential of reducing the take rate in the early phases of deployment, but as the value of the network becomes established, it is likely that there will be much less resistance to paying a connection fee.

5.10 NEW MARKETS TAX CREDIT

New markets tax credits are a form of private sector financing supported by tax credits supplied by the Federal government. The New Markets Tax Credit (NMTC) Program permits taxpayers to receive a credit against Federal income taxes for making qualified equity investments in designated Community Development Entities (CDEs). The CDEs apply to the Federal government for an allotment of tax credits, which can then be used by private investors who supply funds for qualifying community projects. Substantially all of the qualified equity investment must in turn be used by the CDE to provide investments in low-income communities.

The credit provided to the investor totals 39 percent of the cost of the investment and is claimed over a seven-year credit allowance period. In each of the first three years, the investor receives a credit equal to five percent of the total amount paid for the stock or capital interest at the time of purchase. For the final four years, the value of the credit is six percent annually. Investors may not redeem their investments in CDEs prior to the conclusion of the seven-year period.

Throughout the life of the NMTC Program, the Fund is authorized to allocate to CDEs the authority to issue to their investors up to the aggregate amount of $19.5 billion in equity as to which NMTCs can be claimed.

These tax credits can be quite useful, and there may be some areas that qualify. However, it can take up to a year or more to apply and then finally receive NMTC-related cash. This can be a useful long term source of funds.

5.11 SPECIAL ASSESSMENT/SERVICE DISTRICT

Communities like Bozeman, Montana and Leverett, Massachusetts have been funding broadband infrastructure improvements with special assessments (in Leverett, $600/year for five years), and in Bozeman, TIF (Tax Increment Funding) is being used in some areas to add telecom conduit, handholes, and dark fiber. In some localities, it is possible to levy a special assessment in a service district designated for a particular utility (like broadband) or other kind of public service.

Charlemont, Massachusetts intends to add an $11/month assessment to every household to build a town-owned Gigabit fiber network that will pass every household in the community. A town-wide vote supported this funding approach. Put in perspective, the average cost of a large, single topping pizza in the U.S. is currently $9 to $12.

Two small cities in Utah are currently evaluating the potential of a $10-12 utility tax levied on every household and business to finance a full fiber to the premises build out, including a modest "free" Internet service that would be adequate for email and light Web use. Most households will probably choose to select a higher performance Internet package from a private provider on the network. A $10/month special assessment (the cost of one large pizza) on every household in Northampton could raise as much as $40 Million for broadband over twenty years—enough to take Gigabit fiber to nearly every home and business.

The tables below shows the kind of funds that could be generated over several time periods. If ten dollars per month were collected from each household for thirty years, it would easily finance the immediate build out of Gigabit fiber that would pass nearly all homes and businesses in each City.

Individual Service District Examples				
Monthly Assessment Amount	Fifty Homes Five Year Assessment	Fifty Homes Ten Year Assessment	100 Homes Five Year Assessment	100 Homes Ten Year Assessment
$5	$15,000	$30,000	$30,000	$60,000
$10	$30,000	$60,000	$60,000	$120,000
$25	$75,000	$150,000	$150,000	$300,000
$50	$150,000	$300,000	$300,000	$600,000

A lesser amount (e.g. $2/month over twenty years) would easily finance the immediate build out of a comprehensive wide area wireless tower network in each, as well as some fiber infrastructure.

Northampton Special Assessment Examples		
Monthly Assessment Amount	Twenty Year Assessment	Thirty Year Assessment
Number of Households	11,352	
$1	$2,724,480	$4,086,720
$2	$5,448,960	$8,173,440
$5	$13,622,400	$20,433,600
$10	$27,244,800	$40,867,200

5.12 PROPERTY TAX INCREASE

While raising taxes can be politically very difficult, a very small incremental increase in property taxes, with the increase clearly earmarked specifically designated for broadband development (.e.g. one-quarter cent) might be possible to sell to citizens and businesses.

The table below illustrates a hypothetical example of what funds might be raised for broadband improvements with a sample City-wide assessed property value.

	Sample Assessed property value	Broadband increment	Annual Broadband Fund	Ten Year Aggregate	Twenty Year Aggregate	Thirty Year Aggregate
1/4 of one cent	$7,000,000,000	$0.0025	$157,500	$1,575,000	$3,150,000	$4,725,000
1/2 of one cent	$7,000,000,000	$0.0050	$315,000	$3,150,000	$6,300,000	$9,450,000
1 cent	$7,000,000,000	$0.0100	$630,000	$6,300,000	$12,600,000	$18,900,000

5.13 GRANT APPLICATION ACTIVITIES

Activity	Description	Discussion	Tasks
Develop a grant application	The grant application process, from start to award announcement, can be nine to twelve months.	Broadband grant application requirements have become more stringent over time, with more grant agency oversight and review. Careful planning is essential to develop a successful application.	• Once a grant opportunity has been identified, review grant requirements to determine if the project can qualify. For example, some grants require two years of financial history. • Identify regional agency that will assist • Begin contacting potential ISP partners. • If the project qualifies, identify at least two people to take the lead to prepare application. • Prepare a task list of all grant materials requirements and identify data needed. • Develop a timeline for developing sections of the grant. • Identify requirements for letters of support and matching funds and develop timeline to solicit and collect commitments. • Complete all sections of grant application with assistance from public and private partners. • Submit grant application.

Typical Timeline	Months											
Tasks	1	2	3	4	5	6	7	8	9	10	11	12
Determine grant qualifications												
Identify regional council partner												
Identify ISP or WISP partner if needed												
Appoint grant team												
Create grant task list												
Prepare timeline and assign tasks to partners												
Identify matching fund requirements and letters of support to solicit and collect as needed												
Complete all sections of the grant application												
Submit grant												
Grant agency review												
Awards announcement												

6 PARTNERSHIP OPPORTUNITIES

Because nearly all telecom infrastructure includes some use of public right of way, public/private partnerships are always a requirement for broadband infrastructure. Among the City of Northampton and private entities like ISPs and WISPs, the more common synergies are:

- The need for more bandwidth,
- The need for more affordable bandwidth, and
- The need for more affordable bandwidth to be more widely available.

Potential project partners include:

ISPs and WISPs

Throughout the U.S., many ISPs and WISPs are aggressively pursuing public-private partnerships (PPPs) with City governments. These partnerships may include a variety of strategies: collaboration on a grant opportunity, shared costs of developing a new tower site, revenue sharing, fee waivers, and other sorts of cost and revenue sharing. The advantage of this kind of PPP is that the WISP typically is responsible for most of the day-to-day management of the network assets.

The City of Northampton can pursue public/private partnerships with technically qualified and financially stable ISPs and WISPs. Where appropriate, the City could channel grant funds to providers who will use the funds to build and manage new broadband infrastructure—if the City decides not to pursue a City-owned broadband network.

Selected providers should be able to show technical competency and have a demonstrable track record of managing substantial fiber and/or wireless builds on time and within budget. It will also be important for any public/private partnership agreement have a claw-back agreement. When public funds are transferred to a private company, the City should have the ability to "claw back" the built infrastructure for a minimum of five to ten years.

Conditions for a claw back could include bankruptcy of the ISP, sale to a third party (where substantial profit taking leverages the public funds), poor service, unreasonably high cost of service, and/or poor service reliability.

Public Safety

The police department, fire, and rescue departments all need better access to broadband and improved wireless voice/data communications. Throughout the United States, public safety voice and data communications systems are being upgraded, often at staggering cost. Many of the upgrades include new towers to eliminate "holes" in the served area where first responder, fire, and rescue radios do not work. Combining public safety needs with community broadband needs can bring new sources of funding and cut costs, sometimes dramatically. Elected officials may need to take the lead in this area to ensure that public safety officials work collaboratively with the broadband efforts.

The availability of public-safety towers and/or new towers can enable new services and applications for police, fire, and rescue in Northampton. Secure WiFi hotspots can be set up around and near the towers, so that reports can be filed from the field using the WiFi Internet

connection. Other communities that have done this have found that it saves time and keeps patrol cars out in the field longer.

There are often grants available for public-safety voice and data communications improvements, like new towers and upgrades to existing tower facilities, that could also support the broadband initiative. Any public-safety tower or communications expenditure should be analyzed to determine if the expenditure can also support expanded broadband access in the City.

K12 Schools

Northampton schools have adequate broadband service at existing school locations. But K12 students often lack adequate Internet service at home, and some schools are careful not to assign homework that requires Internet access. Parents consistently report on the burden of having to drive children to a public library or some other WiFi hotspot to get Internet access for school work. The City should work with the schools to apply for education grant funds to achieve this goal, and to keep K12 parents informed about broadband activities.

City Businesses

Businesses in the city and the local Chamber of Commerce chapters have an important role to play as advocates for the broadband work of the City. At both the city and state level, businesses that need more affordable and better broadband should ensure that elected officials understand the urgency. The City, as part of its broadband awareness efforts, should ensure that local businesses are kept up to date with work activities, grants, and other efforts (e.g. attend CoC meetings at least quarterly to report on the work of the City).

Electric Utilities

Electric utilities are natural partners in any City broadband venture. Electric utilities own utility poles, bucket trucks, and the equipment needed to install aerial fiber. Chattanooga's fiber to the premises (FTTx) initiative has enabled millions in savings for the city-owned electric service. When power outages occurs from events like ice storms or tree damage, the utility is able to use the fiber network to very accurately pinpoint where the outage occurs, enabling a more rapid repair of the electric network at less cost.

The City should meet from time to time with the local electric utilities to assess their interest in broadband projects, especially if the City and the electric utility could collaborate on fiber to electric service substations.

7 RISKS, LEGAL AND REGULATORY CONSIDERATIONS

7.1 FUNDING

Excellent leadership and hard-nosed business management of the enterprise are essential to the project's ability to obtain necessary funding. Although the network may be operated as a government effort, it must be managed with the same attention to costs, revenue, and financial administration as any private sector business. The project must be able to develop and maintain "investment quality" financial reports and business models to attract private sector sources of funding like revenue bonds, municipal leases, commercial loans, and business contributions. If investments are restricted to basic infrastructure like tower sites, fiber, towers, and equipment shelters, maintenance costs will be relatively low and it should be possible to structure attractive tower space lease rates to cover routine maintenance, minimizing financial risk and requiring limited funding.

7.2 SERVICE PROVIDERS

While in many respects a community broadband network shares many similarities with other public utilities (e.g. roads, water, sewer) there is one fundamental difference. Other public utilities like water and sewer have a captive audience and the utility is able to operate as a monopoly–meaning the customer base can be taken for granted. Early discussions with service providers have been positive, with at least two providers making requests for additional information about the effort.

A community broadband network is a public/private enterprise, and service providers are the primary customers of the network. Service providers cannot be taken for granted. Instead, a fair fee structure, a high quality network, excellent maintenance and operations processes, and organizational flexibility will be required to recruit and retain service providers.

Projects that are not successful in attracting service providers will fail. Affordable lease rates for tower space and/or fiber connections will attract service providers. Other open access projects(e.g. Danville, VA; New Hampshire FastRoads,; Bozeman Fiber; Utopia/Salt Lake City area) have not had any difficulty getting service providers to use the infrastructure. Indeed, the Utopia project has twenty-three providers on its network.

7.3 TECHNOLOGY

A question that often dominates early discussions of community broadband projects is, "Are we picking the right technology and systems?" Everyone has experienced the rapid obsolescence of computers, cellphones, printers and other IT equipment.

There is always some risk associated with making a substantial investment in a network. However the risk can be managed. In a predominantly fiber network, a large portion of the investment will be dedicated to getting fiber in the ground or on poles throughout the community. Properly installed fiber has a minimum 30 to 40 year useful life, and fiber installed by the telephone companies in the seventies is still in use today. Fiber also has a useful property not shared with

other public systems like water, roads, and sewers. The capacity of fiber can be increased without replacing the fiber or adding additional fiber. Instead, fiber capacity can be increased indefinitely by replacing the electronics at each end of the fiber. This means that a community investment in fiber creates a stable, long term asset for the community with long lasting value.

The equipment used to light the fiber has a shorter useful life, and is usually depreciated over a period of 7 to 9 years. Some equipment may remain useful longer than that. Wireless equipment must be replaced much more often (typically 2 to 4 years of useful life) because it is typically exposed to much harsher conditions (extreme heat and cold, lightning strikes, ice, snow, rain, wind).

The primary technology risk is selecting a vendor who provides equipment that does not perform as advertised. This risk can be managed by a careful procurement process which would include a careful analysis of network capacity and features, detailed RFPs that specify equipment features and functions explicitly, and a thorough RFP evaluation process.

7.4 LEGAL AND REGULATORY ISSUES

Regional and local government-owned broadband projects are subject to state and Federal regulations of various kinds, but unless a project is offering retail services (e.g. the local government is selling Internet, TV, and/or voice services directly to residents and businesses), there are limited regulatory issues. The City of Eagan's AccessEagan Gigabit fiber network has been in operation for seven years, and has four private sector service providers offering services. There has never been an incumbent legal challenge because incumbent providers like Comcast and CenturyLink have been invited to use the network (both have repeatedly declined).

The key strategy is for local government-owned projects to adopt the wholesale model of leasing passive infrastructure like towers and dark fiber and for active networks (with network electronics) to lease circuits to providers on a wholesale basis rather than selling retail services. While Wisconsin law prohibits local governments from offering telecommunications services, the dark fiber leasing model proposed for the middle mile network in Section 5 is not a telecommunications service, and local government and/or regional entities would not be selling any telecommunications services.

The Utopia project, which offers services in fourteen communities in the Salt Lake City area, has been targeted in the past as a "failed" effort but has overcome some early financial challenges and today has 23 private sector providers offering a wide range of price points and service packages—delivering true choice and competition to citizens and businesses. The wholesale model is not subject to many of the FCC (Federal Communications Commission) regulatory requirements.

APPENDIX A: GLOSSARY

Active network: Typically a fiber network that has electronics (fiber switches and CPE) installed at each end of a fiber cable to provide "lit" service to a customer.

Asymmetric connection: The upload and download bandwidth (speed) are not equal. Cable Internet and satellite Internet services are highly asymmetric, with upload speeds typically 1/10 of download speeds. Asymmetric services are problematic for home-based businesses and workers, as it is very difficult to use common business services like two way videoconferencing or to transfer large files to other locations.

Backhaul: Typically refers to a high capacity Internet path out of a service area or locality that provides connectivity to the worldwide Internet.

Colo facility: Colo is short for Colocation. Usually refers to a prefab concrete shelter or data center where network infrastructure converges. A colo or data center can also refer to a location where several service provider networks meet to exchange data and Internet traffic.

CPE: Customer Premises Equipment, or the box usually found in a home or business that provides the Internet connection. DSL modems and cable modems are examples of CPE, and in a fiber network, there is a similarly-sized fiber modem device.

Dark fiber: Dark fiber is fiber cable that does not have any electronics at the ends of the fiber cable, so no laser light is being transmitted down the cable.

Fiber switch: Network electronic equipment usually found in a cabinet or shelter

Fiber Optic Splice Closure: See **FOSC**.

FOSC: Fiber Optic Splice Closure. Typically a water and air tight cylindrical container where fiber cable is split open to allow splicing (connecting together) of fiber strands for a drop to a premises.

FTTH/FTTP/FTTx: Fiber to the Home (FTTH), Fiber to the Premises (FTTP), and Fiber to the X (FTTx) all refer to Internet and other broadband services delivered over fiber cable to the home or business rather than the copper cables traditionally used by the telephone and cable companies.

Handhole: Handholes are open bottom boxes with removable lids that are installed in the ground with the lids at ground level. The handholes provide access to fiber cable and splice closures that are placed in the handhole. Handholes are also called **pull boxes**.

IP video: Video in various forms, including traditional packages of TV programming, delivered over the Internet rather than by cable TV or satellite systems.

Latency: The time required for information to travel across the network from one point to another. Satellite Internet suffers from very high latency because the signals must travel a round trip to the satellite in stationary orbit (22,500 miles each way). High latency makes it very difficult to use services like videoconferencing.

Lit network: A "lit"network (or lit fiber) is the same as an active network. "Lit" refers to the fact that the fiber equipment at each end use small lasers transmitting very high frequency light to send the two way data traffic over the fiber.

MST: Multiport Service Terminals are widely used in fiber to the home deployments to connect individual home drop cables to larger distribution cables on poles or in handholes. Pre-connectorized drop cables snap into the MST ports and do not require any splicing.

Passive network: Refers to infrastructure that does not have any powered equipment associated with it. Examples include wireless towers, conduit (plastic duct), handholes, and dark fiber.

Pull boxes: Pull boxes (also called handholes) are used to provide access to fiber cable and splice closures. They are called pull boxes because they are also used during the fiber cable construction process to pull the fiber cable through conduit between two pull boxes.

Splice closures: Splice closures come in a variety of sizes and shapes and are used to provide access to fiber cable that has been cut open to give installers access to individual fiber strands. Splice closures are designed to be waterproof (to keep moisture out of the fiber cable) and can be mounted on aerial fiber cable or placed underground in handholes. Also called **FOSC**s.

Splicing: The process of providing a transparent joint (connection) between two individual fiber strands so that laser light passes through. A common use of splicing is to connect a small "drop" cable of one or two fiber strands to a much larger (e.g. 144 fiber strand) cable to provide fiber services to a single home or business.

SCADA: Supervisory Control and Data Acquisition. Used by the electric utility industry and some other utilities (e.g. water/sewer) to manage their systems.

Symmetric connection: The upload and download bandwidth (speed) is equal. This is important for businesses and for work from home/job from home opportunities.

Virtual Private Network: A VPN creates a private, controlled access link between a user's computer and a corporate or education network in a different location. VPNs are often encrypted to protect company and personal data. VPNs usually require a symmetric connection (equal upload and download speeds) to work properly.